# The Chemical Age

**A Weekly Journal Devoted to Industrial & Engineering Chemistry**

VOL. I. JUNE 21 1919 No. 1.

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*The prepaid subscription to "The Chemical Age" is 21/- per annum for the United Kingdom, and 26/- Abroad. Cheques, P.O.O.'s, and Postal Orders should be payable to Benn Brothers, Ltd.*

*Editorial & General Offices—8, Bouverie Street, London, E.C.4.*
*Telegrams: "Allangas, Fleet, London." Telephone: City 9852 (4 lines).*

## Our Programme

THE presentation of the first number of THE CHEMICAL AGE calls for a brief statement of its general aims and policy. Our justification for issuing a new weekly journal, to be specially devoted to the interests of chemical science and industry, lies in the consciousness of the enormous advance which the British chemical industry has made during the war, of the imperative need of consolidating and developing the gains already won, and, in particular, of seeing that the predominance over British products which Germany had too long enjoyed shall not be recovered. It will be our special aim, therefore, to support all movements for the development of the British chemical industry, whether from the scientific or from the industrial point of view. An unprecedented opportunity lies before us. The need for a vigorous constructive and progressive policy, in order that this national opportunity may not be lost, was never so imperative as to-day. It is such a policy that we shall hope effectively to inform and stimulate.

There is a general feeling that no sufficiently serious attempt has hitherto been made to meet the demands of the chemists of this country in the way and to the extent they have been provided for in America and in Germany. Science and industry are so closely interwoven that the so-called commercial man, in order to safeguard his interests, must gather round him a staff of technicians. Much of the inefficiency and waste which characterised the past can be traced to a lack of sympathy and contact between the practical exponent and the scientifically trained man. Fortunately, the exigencies of war have removed this barrier, with the result that the whole industrial world has begun to appreciate the essential relation between scientific principles and the economic prosecution of industry.

The chemical industry to-day is largely dependent for its progress upon co-ordination of effort between the commercial man, the chemical engineer or industrial chemist, and the pure scientist, and only by means of some such combination can success be expected or attained. From the outset, therefore, we shall try to serve all these allied interests rather than to appeal to any special section. In reference to contemporary publications we set out in no spirit of opposition, fully believing that an industry already great, and faced with enormous possibilities of extension, can find profitable use for a new weekly paper of a high character. On the contrary, our purpose will be to augment rather than to duplicate the efforts of others, and especially to impress upon the British expert and manufacturer the vital need of a progressive policy. To this end we shall welcome from our readers any suggestions, correspondence, questions, or notes of general interest. In return we ask for their assistance and indulgence, particularly in our early efforts.

As a result of the war there has sprung up among industrial chemists some tendency to regard any serious opposition as improbable; but it must be remembered, in spite of the severity of the Peace terms, that Germany as a nation possesses great powers of recuperation, and that in the near future she will certainly make strenuous efforts to regain her supremacy in chemical production. Nor is it to the future Germany alone that our eyes must be directed. From across the Atlantic comes a determined bid for our markets by one of the most enterprising and progressive nations in the world. Activities such as these from two widely different quarters and nations can only be met by corresponding, if not superior, effort and enterprise on our own part. If these are forthcoming the prospective struggle for supremacy may be viewed with confidence, for the experience of the war has proved that although our technical men may have lacked a certain amount of application in the past they are, when put to the test, unsurpassed in brilliance and originality.

# The Future of the British Chemical Industry

## Special Messages for our First Number

We have pleasure in publishing the following interesting opinions on the future of the British Chemical Industry, which the writers have been good enough to contribute specially for our first number :—

### The Right Hon. H. A. L. Fisher, M.P.

*(President of the Board of Education).*

To-day the co-operation of Science and Industry is vital to the welfare of the country. The War has been won with the help of Science; and it is only with the help of Science that Industry can be re-established and fitted to meet the demands which will be made upon it by a world seeking to repair the ravages of four years of conflict. Scientific guidance is required in industry for the elimination of waste, both of labour and of material, for the improvement of old processes and for the discovery of new.

The man of Science, with his trained powers of observation, and a habit of independent thought, when presented with industrial problems, tends to see them from a new angle. A fresh mind, specially trained in the methods of scientific research, may quickly find the solution to difficulties which have baffled those who have long been in contact with them —so long, perhaps, that they have been accepted as insoluble. And even if the scientist does not immediately succeed in giving a complete answer to the problem before him, his training and knowledge will generally indicate to him the points at which it may be most hopefully attacked.

Industry must not only seek the help of Science, but must also realise that in its own best interests it must not seek to monopolise the services of Science. Science must be free to continue along its own paths, however unpracticable may seem at first sight some of the ends to which they lead; the most recondite and academic scientific research to-day may be the foundation of the new industry to-morrow.

In the partnership of Science and Industry enduring success will only be won if the partners show consideration one for the other. The manufacturer must be prepared to give liberal rewards to the scientist whose aid he invokes, recognising that the best work and the clearest thought will not be obtained from one who is largely preoccupied with the struggle to make both ends meet. Patience, sympathy, and a courageous faith in Science will often be needed on the manufacturer's part when the solution of a difficult problem involves a long and laborious process of research which seems slow in reaching its goal. On his side, the scientist who works for the manufacturer must enter upon his industrial work with a mind impressed with its dignity and importance, willing to concentrate his full powers upon the industrial problems put before him, and refusing, while engaged upon them, to be led into by-paths of investigation that have no value for the manufacturer.

I am convinced that closer co-operation between Science and Industry cannot but prove of the greatest advantage to both, and that upon the development of that co-operation the future of civilisation must in the main depend.

H. A. L. Fisher.

### The Right Hon. Lord Sydenham, G.C.S.I., F.R.S., &c.

*(President of the British Science Guild and of the Association of Technical Institutions).*

In my humble opinion, no industries hold out brighter prospects of successful development than those which are based upon chemical research. A glance at the "Summary from the Census of Production, 1907," which was published in *Nature* some years ago, will show that these industries yield by far the greatest value in output per head. The figures also indicate the importance of skilled technologists, of whom we still possess too few.

During the war a great impetus was given to chemical industries, because we suddenly found ourselves forced to seek independence of certain foreign imports, of which the Germans, with deliberate military designs, had acquired almost a monopoly of manufacture. The fine work of our great chemists, utilised for the first time to the fullest extent, not only enabled us to make good the neglect of the past before it was too late, but pointed the way to progress on a large scale.

Our future prosperity depends to a great extent upon industrial chemistry, which still holds many valuable secrets that our leaders of science are well able to discover. The conditions of success are research without stint, and enterprise on the part of manufacturers in quickly applying the rich gifts of science.

By subsidising and systematising research, the Government can render aid of the greatest importance, and our educational establishments can supply the trained workers who are needed. We shall have to face severe competition, not only from America, where the manual workers have not become accustomed to restrict their efforts, but from Germany, which will in a short time show marked recuperative power and capacity for work. Unless industrial peace can be attained on the basis of mutual understanding and the common interests of labour and capital, the overseas trade, which is vital to the existence of the population, will pass out of our hands and poverty and unemployment will grow to dangerous dimensions.

Sydenham.

### Lieut.-General Sir Alfred Keogh, G.C.B., M.D.

*(Rector of the Imperial College of Science and Technology).*

There never was a time in the history of applied science when it was more necessary than now that the applications of science should be constantly brought to the notice of the student of chemistry. This, I think, is now generally recognised. The war has brought the educational institutions into close touch with practical problems, and perhaps it is not too much to say that the practical man has become acquainted with the possibilities if practical problems are presented to University schools. If, as one may hope, the schools and the factories can be intimately associated in scientific work there need be little fear for the scientific future of British industries.

Alfred Keogh.

### Sir Edward Thorpe, C.B., LL.D., F.R.S.

*(Editor of Thorpe's "Dictionary of Applied Chemistry").*

I am interested to note the issue of a new weekly journal to be devoted to the interests of applied chemistry, and I wish the venture every success. The particular time of its appearance is most opportune. It will serve to bring home and to emphasise the lessons of the strenuous years through which we have recently passed. There can be no question that British chemical industry has received an impetus such as only the shock of a great and prolonged European war, fought under modern conditions and with every appliance which science could suggest, could have given it.

The State is now more than ever alive to the paramount importance of science to the national welfare. It recog-

nises, indeed, that its very salvation is in no small measure due to the applications of chemistry. The first few months of the war brought, as we well remember, a rude awakening in this respect. The country at large, for the first time, realised how dependent it had become on Germany for much that was essential to its well-being and economic position. This realisation roused some of the most characteristic qualities of our race. The four years of war have probably done more than forty years of peace to quicken our recognition of the jeopardy in which we stood. They have strengthened our determination to regain that supremacy in the chemical arts that we formerly enjoyed. The effort has taught us that it rests with ourselves if we are to secure it. We have learned to know that there is no innate superiority in the German genius even in those departments of pure or allied chemical science in which our enemy boasted that it was unassailable.

It remains to be seen, however, how we continue to profit by the opportunity which the war and its fortunate result have brought to us. It should be the policy of THE CHEMICAL AGE to neglect no chance of enforcing the lessons of the war, or of stimulating our activities in making good the enormous possibilities for our chemical industries that it has opened out for us.

It must be clearly recognised that in spite of her military collapse and economic prostration, Germany is very far from being beaten as regards chemical production, and that she is preparing to make every effort to retain and enlarge the monopoly she has hitherto enjoyed in certain sections. She still possesses many initial advantages, the fruits of nearly half a century of ceaseless activity and organising skill. The competition is bound to be severe, and all the more so that it will be actuated and impelled by the knowledge that her economic salvation is largely bound up with it.

Nor must it be forgotten that we are not alone in recognising the possibility that the war has altered the whole future aspect of chemical industry. Both in the Far East and the Far West there are enlightened and enterprising nations who are making great attempts to establish staple chemical manufactures on the widest possible scale, and are thereby seeking to gain pre-eminence in the markets of the world.

The opportunity we now have will probably never recur. May we be wise and seize it! T. E. THORPE.

### Colonel Sir E. A. Brotherton, Bart.

The chemical industry has been giving its energy unsparingly throughout the war to the production of explosives, and of other chemical products whose use has been demanded by conditions introduced into modern warfare. Apart from experience thus gained, and which may now be applied in the production of substances required in the industries of peace, its progress may be described as comparatively small. In certain branches of the industry, however, notably in the preparation of pharmaceutical products, much has been done to make us independent of foreign supplies. The business in sodium hydrosulphite and its compounds, which in pre-war days was wholly German, has been acquired by Brotherton & Co., in their purchase of the Mersey Chemical Works from the Public Trustee.

In my opinion, the policy which should be followed in order to maintain and still further develop British chemical industry is to prohibit the import of foreign manufactured chemicals except under licence from the Board of Trade. Users should be required to deal with British makers unless they can show either that the product is unsuitable or that the manufacturer of it is taking advantage of the situation to exact too great a profit.

EDWARD A. BROTHERTON.

### Dr. Charles Carpenter, M.Inst.C.E.

*(Chairman of the South Metropolitan Gas Co.).*

The experience of the last five years has shown that the country that produced Dalton and Watt can hold its own in the science and industry of chemistry if its importance is recognised by the State. This country's chemists are already the equal of those of any other nation; its engineers can become so if they are allowed the opportunity of building up and extending this new development of their craft. The profession of chemistry is no less honourable than that of medicine, but our inept political system has been mainly responsible for its discouragement. I believe that if the country had been offered in pre-war days "cheap" energy from Germany through a submarine cable, the Government would have supported the proposal. It is wiser to-day, but the price paid has been a heavy one.

CHARLES CARPENTER.

### Dr. M. O. Forster, F.R.S.

*(Director of the Salter's Institute of Industrial Chemistry).*

It is from the chemical standpoint, more than from any other than the naval or military, that the past five years have been the most eventful in the history of our country. A complete transformation has been effected, the importance of which is even greater in its psychological than in its material aspect. The reflective elements of the British race have at last been brought to realise that safety in war and prosperity in peace depend upon the intelligent application of scientific methods to the numberless processes involved in our daily lives.

Even when due allowance for human forgetfulness, especially British forgetfulness, has been made, it is not possible that the influence of these years will be lost. Its effect upon education and industry is already noticeable, and whilst the change in educational outlook must bear its fruit more slowly, the advances made by industrial development are readily measurable.

Amongst these I place first in importance the spirit of co-operation which has linked the universities to the factories. The wide enlistment of academic chemists in the ranks of the factory staffs and the establishment of research associations in connection with various branches of industry cannot fail to strengthen the bonds of this newly discovered brotherhood. Certainly there have been casualties, and with equal certainty more will follow; but in which branch of human endeavour are they not involved? Much of the seed has fallen on stony ground, but there remains for all time the cold fact that against the most powerful military combination ever developed, exerting all the force for which forty years of scientific preparation had furnished the mainspring, a victory has been gained by rapid mobilisation of those very principles which formerly were so grievously neglected in this country.

The danger which confronts us in the future is failure to perceive that the grasp of these principles must not be relaxed. It is possible to hold and develop, during the years of peace, that which has been gained under stress of war, but it is possible only by encouraging individuality wherever revealed, by bringing this into harmony with the common welfare, and by strict adherence to the principle of co-ordinating the several contributions which every section of the chemical community may be able to make. Finally, continued efforts must be made, even in face of every sort of discouragement, to maintain these principles as between the different countries comprising the Alliance.

M. O. FORSTER.

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### Professor Arthur Smithells, C.M.G., F.R.S.

*(The University, Leeds).*

I think it has become much more clearly evident during the war that the maintenance and development of a large range of British industry must depend upon the infusion into it of an abundant supply of highly trained chemists, and no doubt those who are charged with the duty of training chemists will have increased responsibilities to meet. The policy of this University has been to build up, beside the department of pure chemistry, a certain number of departments devoted to branches of applied chemistry. We have thus separate chairs of applied chemistry in relation to colour chemistry and dyeing, the leather industry, coal gas and fuel industries, and agriculture.

I should like to express my strong belief in the soundness of this policy. I know that there has been a good deal of scepticism both on the side of science and of industry as to the possibility and advisability of the university teaching of applied chemistry. A fundamental knowledge of chemistry itself is undoubtedly the essential intellectual capital for all chemists, and no doubt some spurious teaching of applied chemistry has been attempted, but I am convinced by experience that in the hands of the right man—certainly very difficult to secure—university teaching in applied chemistry of the most valuable kind is possible. I hope to see it greatly extended, different universities taking up different specialities and arranging for an easy transfer of students.

I should like also to lay stress on the value of associating departments of applied science with advisory committees on which industrialists have ample representation. Without exercising undue control such bodies can have a most useful influence in establishing sympathy and understanding between the two camps of science and industry.

Lastly, I must confess to having watched with great anxiety the recent policy of placing scientific and industrial research under the control of a State department.

ARTHUR SMITHELLS.

### Mr. James Swinburne, F.R.S.

During the war the entry of chemicals from Germany was cut off, and the demand for munitions created a supply which will not be wanted. This munition demand must result in a great deal of scrapping, which is unavoidable. There has been a great development of electrolytic plant capable of producing chlorine; and there is now a chance of bleach being in excess, more especially as these works have also been put up abroad. This is largely due to the universal demand for poison gas.

Before the war we imported a great deal more than we sent out. As we have parted with much of our oversea property, if our exports remain the same, our imports will go down. Further, if, for instance, through the difficulties in the coal trade, our exports fall considerably, as they probably will, it might be expected that our chemical imports will fall, and more chemicals will therefore be made at home. But the same influence will cause our home trade to fall.

In 1914 the handworker lived in a certain degree of what political economists call comfort, and capital got a certain interest. Now capital is scarce, as we have used up a great deal of wealth. Equilibrium will be reached only by going through a period of scarce capital and high interest. Capital, being scarce, has the whip-hand, and however sympathetic and humane the capitalist may be, scarce capital and excess of labour means low living and hard work for the handworker, and this must inevitably go on till the high profit on capital has caused enough to be saved for labour's value to rise to its normal again. But at present we are spending our still available capital in absurd sentimental attempts to make labour much better off than before the war, which is impossible. We are thus putting off the bad time for labour which must come soon, and we are making certain that the suffering when it does come will be as acute as possible, by spending as fast as we can, and leaving the matter in the control of politicians and Government officials who are entirely ignorant of economics, and who not only squander the country's money, but interfere with industry in all directions.

The chemical is only one of many industries which have to face a bad time for the present. It may be divided into two broad classes: heavy chemicals, such as crystals, caustic, bleach and acids; and light products, such as drugs and dyes. The heavy industry is largely dependent on coal, and its immediate future is not bright. Coal is certain to be dear for some time; and this will handicap heavy chemicals and make it impossible to secure our position as exporters. When coal comes down, and low living and unemployment are general, it will be too late. Moreover, that will be a period of great trouble. There will not be strikes because there will be too little available employment; but there will be suffering, discontent, and probably rioting and tendency to revolutions. It will not be the petulant discontent of classes that have been pampered and flattered during a war, to get munition work done, and have lost their heads, and let themselves be exploited by a small and noisy bunch of ignorant men; it will be the misery of men underfed, under-employed and hopeless, comparing their lot with their times during the war, that will strain the cohesion of society.

This again is true of many industries. The chemical has some features of its own. We are told that there is a great want of trained chemists and of commercial men who will value, and perhaps even pay them. Now is the time for developing chemical invention. There is probably a larger field in manufacturing chemistry than in any other industry. The chemical manufacturer is too often purely a business man, and is supposed to be ignorant and conservative, and to object to taking up new technical methods. Is it not possible that the chemist is to blame? An inventor of a new process comes to a works. The responsible head asks his works chemist to report. The works chemist feels that if he says "Yes," and the scheme is taken up and goes well, he gets no credit, and may be supplanted, while if it fails he is blamed. If he rejects it, the invention has another precedent against it, and may never be taken up by anybody. He has thus an unconscious bias against anything from outside, however fair he may be. This difficulty does not exist where the head man is technical; and it is thus better that the responsible manager should be a capable chemical engineer.

It is the habit of the publicist to say that English business and technical men are behind the times; but there is no evidence of it. We certainly produce scientific and technical chemists second to none; and when we get through the ordeal of the immediate future the British chemical industry has nothing to fear, except Government interference, which is now threatening all our industries.

J. SWINBURNE.

### Dr. E. H. Tripp

*(Review Editor of the "Journal of the Society of Chemical Industry").*

The future progress of British chemical industry is conditioned by so many factors that one may be pardoned for passing all of them by save one, of which the importance can hardly be over-estimated. Just as the State was identified by some with the personality of its ruler—*L'Etat, c'est moi*—so is chemical industry bound up with the nature and nurture of the chemist—*L'Etat chimique, c'est le chimiste.* Important as the organisation and development of the material resources of chemical industry undoubtedly are, the organistion and development of its personal resources demand at least an equal share of attention.

Steady progress is being made in the movement to organise scientific and technical workers and to secure for them an improved status in social and public life, and this progress is likely to continue provided separatist tendencies can be kept under and individual interests subordinated to the common weal. The related question of development is, however, of more fundamental importance. The lack of an adequate supply of trained students, ripe for works' practice, has long been a problem confronting the industry, and recent events have brought it into greater prominence.

The causes of this shortage may be many, but the remedy is one. The budding chemists will not be forthcoming unless and until the universities and higher technical colleges are provided with the necessary means—viz., large funds and properly " dressed " human raw material from the secondary schools. The schools will do little until they can attract, and retain, first-class men as teachers; such men will not enter the profession until its status and its emoluments have been materially improved. These desiderata will not be attained until the public has recognised that the rôle of teacher is of basic importance; and the public will not " see light " until it is educated.

The fundamental policy to be advocated for the furtherance of British chemical industry, and of all other industries based upon science, is, therefore, that the mass of men be brought to know something of science and its methods, and of their intimate connection with human welfare. One means of accelerating progress would be the undertaking of a comprehensive scheme of semi-popular, but sound, scientific publications, edited by men of the stamp of Huxley and Tyndall, written by real workers in the sciences and industries, and made attractive by the co-operation of technical journalists. Such work would hardly touch the spheres of the technical journals, but these should be useful as ready sources of reliable and up-to-date information.

The field for technological journalism is ever growing and there is scope for all; but in the interest of economy it would be desirable to arrive at some understanding in connection with the demarcation of frontiers and spheres of influence. Although in scientific and technological literature there is not a tithe of the iniquitous waste which characterises the popular literature of the day, there is yet room for some co-ordination of effort. Thus the trade journals might confine their attention mainly to distribution and exchange, and the " industrial " journals to production. In addition to such publications there is undoubtedly scope for a high-class weekly or bi-weekly journal devoted to chemistry, pure and applied, to purvey news, shorn of journalistic verbiage, and which would open its columns to research workers and others who may desire to secure priority for their work by publishing it in a preliminary and summarised form. Every chemist will, or should, watch with interest and sympathy the efforts of the new journal to till this fertile field. It is true that *the* chemical age has not yet arrived, but it is dawning. May its namesake prove a worthy and successful herald!

E. H. Tripp.

### Mr. R. B. Pilcher.

(*Registrar of the Institute of Chemistry*).

If The Chemical Age sets out to help the science of chemistry and the profession of chemistry, as well as chemical industry, it will be trebly welcome. The development of chemical industries in this country during the war has been very remarkable in certain directions, but that development has been due mainly to the absolute necessity for providing material for the prosecution of war, and has only been possible through the assistance of highly qualified chemists. Apart from the larger problem of holding our own in the markets of the world, a strenuous endeavour must be maintained if we are to be self-supporting in many essential commodities. The arts of peace must also demand the co-operation of the chemist or there will be little prospect of success.

For many years highly competent chemists have been trained in our universities and colleges only to find that the opportunities available to them were so few that far too large a proportion of them had to turn to teaching in schools or to seek appointments abroad. Not less than fourteen per cent. of the Fellows and Associates of the Institute of Chemistry—with few exceptions, educated at home—were abroad in August, 1914. Many of these and many others came home to fight or to help in our factories; but they are returning, and we shall see a further exodus abroad of highly trained men whose services will be lost to this country unless our manufacturers engage chemists in far greater numbers and under more reasonable conditions than have been usual in the past.

Our friends in the United States are fully alive to the value of employing good chemists and plenty of them, and they have got a good start of us, but signs are not wanting that the demand at home is improving, although it is chiefly for chemists with special experience, who are not always available. The experience of the war, however, has proved that a well-trained chemist can speedily adapt himself to the conditions of any industry on which his science has a bearing, and this should be borne in mind by all who seek to take part in maintaining and still further developing the British chemical industries in the future.

Richard B. Pilcher.

### Professor J. B. Cohen.

(*Professor of Organic Chemistry, Leeds University*).

I may say that not being directly and only very indirectly connected with British chemical industry I cannot offer any opinion on what has been done during the war.

In regard to the future I think you have answered it in the outline of your programme of the aims and policy of your new journal, viz., that to maintain and develop the British industry there must be co-ordination between science and technology. This is so old a statement and so fully recognised by the scientist and the more progressive technologist that it has become almost a platitude, and yet it seems as if it required constant repetition.

Connected as I am with the teaching of organic chemistry, a subject which underlies some of our largest chemical industries, I see the importance of our universities and technical colleges being supplied with adequate funds for up-to-date equipment, together with scholarships and maintenance grants for promising young research chemists and, not least, sufficient funds for the proper staffing of the departments.

J. B. Cohen.

### Mr. A. A. Campbell Swinton. F.R.S.

My subject is electricity, and not chemistry, and I scarcely feel qualified to write anything in regard to the two specific questions that you mention. I may say, however, that it is my view that, in spite of all that has hitherto been done in regard to electro-chemistry, the fringe of this subject has only so far been touched, and that electro-chemistry, including electric osmosis and other similar processes, is likely to develop enormously and to become of increasing importance in the near future. Indeed, electro-chemistry is, I think, one of the most fruitful fields for exploration, both commercial and scientific, that exists at the present time.

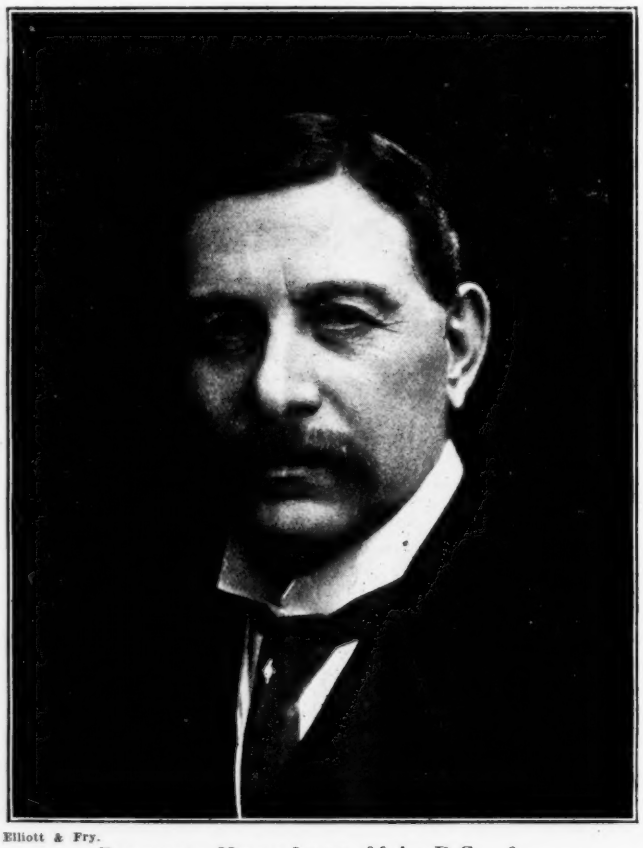
A. A. C. Swinton.

*(Other messages which, unfortunately, we are unable to find space for this week, will appear in our second issue.)*

# Chemical Science and Chemical Industry

## An Interview with Professor Henry Louis.

THERE is no better-known figure or more genial personality in the British chemical world at the moment than Professor Henry Louis, of Newcastle, who next month will complete his second year as President of the Society of Chemical Industry. Apart from his teaching and consultative work in this country, he has had a wide experience of industrial enterprises in various parts of the world, and this gives to the views he has been good enough to express in the course of an interview for our first issue a special interest and authority. He is one of the few representatives of chemical industry who is also a member of the Institution of Civil Engineers, and this, together with his intimate knowledge of mining and metallurgy, enables him to speak with particular authority on matters connected with chemical engineering and industrial chemistry. Professor Louis has been, as President, more than ever interested in developing the work of the Society of Chemical Industry, especially through its excellent Journal, and it will be seen from the statement of his views which follows that he looks back, both on the work of the Society during his presidency and on the part which British chemists and chemical engineers generally have taken in winning the war, with complete satisfaction.



Elliott & Fry.

PROFESSOR HENRY LOUIS, M.A., D.Sc., &c.

### Chemistry in the War.

"It has been," he said, speaking of his presidency, "a very interesting and also a very trying two years, because we have been up against difficulties of quite an exceptional character. We were turned out of our old quarters by the Government at short notice, and in the midst of the difficulties caused by being compelled to move and to reorganise our office the Government commandeered our printers. Added to these difficulties came the scarcity and high price of paper, and the difficulty of getting printing done with anything like the perfection or the despatch to which we had been accustomed. At the same time all our leading members were overwhelmed with work; I cannot recall the name of a single chemist of any note who has not been engaged in some form or other of war work, in addition to being often occupied with his various ordinary activities. It may be said that the war was really based on applied chemistry, for the two facts which enabled Germany to go to war were (1) that an English chemist discovered how to make "basic" steel from phosphoric iron ores, and (2) that Mr. S. Eyde, a Norwegian electrician, had practically applied the English discovery of producing nitric acid from atmospheric nitrogen.

"People talk of the process for the production of synthetic ammonia as the 'Hoben' process, it being one of the German principles that every German who improves, develops, or applies someone else's process shall at once christen it by his own name and claim it for Germany. But the first patents for the synthesis of ammonia from its elements by the use of catalysts were French and English; Charles Tellier took out patents for this as far back as 1865; an important patent was taken out for the same purposes in Norway in 1896, and again by Le Chatelier in France in 1901 for the employment of high pressures to increase the rate of combination of the elements. It was only Germany's pressing need for nitrates to make her warfare possible that caused her to spend vast sums in the direction of elaborate factories for carrying out these already well-known processes upon a manufacturing scale, and thus complete the second link in the chain with which Germany intended to fetter the world. Until the two things I have mentioned had been done Germany could not possibly have gone to war. Unfortunately, it is true that Germany has been accustomed to use her chemistry in a rather brutal fashion. In an old dictionary of chemistry I believe, if I may trust my memory, there is a definition of chlorine as 'a gas which is used in England for bleaching, and in Germany as a means of torturing prisoners,' and it is said that this is not a very great exaggeration. In any case, it was the two facts I have mentioned—the fixation of nitrogen and the dephosphorisation of steel—which from the German side made the war possible.

### The Work of the Society

"As regards our own work I think we may claim for the Society of Chemical Industry that it has done some really valuable national work during the war. One of our most important tasks has been to keep English chemists as well informed as possible of all that was being done in the chemical and allied industries. We have been collecting all the available patent literature, abstracts of current literature, descriptions of processes, &c., and generally supplying the English chemist with a mass of scientific and technical information which otherwise he would have had to search for all over the world. We have been able, too, to give useful assistance to Government Departments in supplying them with scientific and technical data, and in helping them to make the most effectual use of them. I think we have every reason to be well satisfied with the work we have been able to do, and the way in which Government Departments have repeatedly been coming to us for advice and information is good evidence of the value of the Society's work. We have been steadily progressing for some time past, and our future will probably lie in

developing existing activities rather than in striking out along new lines. Since the war we have altered the form of our Journal, and the Review, which we have now made a leading feature, is proving a great success. It used to be said that we were a little too scientific and not sufficiently industrial; of late, by means more particularly of the Review, we have been trying to write up subjects which interest manufacturers more especially, and here we have met with the most encouraging success."

### The German Method.

Turning to the future of British chemistry, Professor Louis frankly recognised the advances made by America, and the past successes of Germany. "In the case of America," he said, "we cannot help it; the Americans got their chance, and of course took it, and I sincerely hope that in the future we shall work closely together. I have no objection to and no fear of open, honest competition, for this cannot but benefit all competitors, and, indeed, the whole industry. But with Germany the position is different, and we ought to profit from past experience. To a large degree the Germans owe their lead in the past to their painstaking way of working at detail, and to their effective methods of advertising themselves. Everybody has heard of the Bunsen burner and the Welsbach light; two Germans invented improvements, the former in the application of coal gas to heating purposes, the latter in its application to lighting purposes, and forthwith attached their names to these improvements, whose Teutonic origin is thus impressed on all men. But how many people remember or have even heard of William Murdock, the man who made the great basal invention, of which these others were mere developments? The British inventor of gas-lighting never troubled about affixing his name to the real master invention, and in consequence the general public forgets the Briton, the real inventor, while it is glib enough with the names of the Germans who followed up.

"There you have the case of an Englishman who invents the cardinal basis of a whole industry and is absolutely unknown, and then the Germans, by making some subsequent improvements and attaching their names, get all the advertisement out of it. This kind of thing is constantly happening. Of course, Germany has got its name as a chemical nation largely by means of German chemical literature. I have before me a list of 513 journals and similar publications dealing with chemistry, chemical industry, and all related branches, and out of these no fewer than 195 are German; if I eliminated from this list all the publications that are more closely connected with engineering than with chemistry, the numerical preponderance of the German publications would be very much more marked. All this activity and enterprise is to be commended, but for the future we must take fuller account of such matters and not allow the work of British chemists to be exploited by other nations for their own profit. British literature and that of the Allied nations must take the place to which their working activities entitle them."

### The July Meetings.

Professor Louis is naturally looking forward with great interest to the July meeting of his Society in London. "It is our hope," he stated, "that our July meeting will crystallise into definite form an inter-allied federation of chemical associations, one purpose of which will be to produce publications in the inter-allied languages to replace those German publications of which I have just been speaking. This inter-allied idea promises to be one of the most prominent features of our forthcoming meeting, and I hope it will prove permanent. There has been talk for some time of trying to form some kind of federation between chemical manufacturers of the Allied nations. I was opposed to this method of procedure, because I felt we ought first to try to get to know each other on the scientific side, where no question of commercial rivalry or competition could arise, and as we gradually learn to know and trust each other, to allow the alliance to grow naturally until it includes the industrial side also. I feel that in this matter we ought to be able to collaborate very usefully. For instance, Dr. M. H. Howe, of the United States, recently convoked in London a meeting with the object of forming an inter-allied federation for the testing of materials of all kinds, and my own feeling is very strongly that this principle might be profitably extended and that an inter-allied research federation might also be brought into being."

### Chemists in Industry.

On the question of the larger employment of chemists in industry and a more liberal provision for research the case of the Mellon Institute at Pittsburgh was mentioned. "They have adopted," Professor Louis said, "a scholarship system there, but I don't yet know whether it is going to be successful. The real trouble here is that if chemical or any other industries want the services of the scientific man they must be prepared to pay him adequately, and this they have not done in the past. It very often happens that young men come to me wanting to be trained as works chemists. I tell them that we can give them the necessary training at Armstrong College, but that it would be better for them to take up some other profession with better prospects. The commercial man, to put it plainly, wants to be educated as to the value of the scientific man in industry, and our standpoint in this country requires to be considerably altered. We generally speak of 'Commerce and Industry' as if commerce came before industry, whereas industry comes before commerce and commerce is dependent on industry. Yet the plain fact is that the man who sells stuff is better paid than the man who makes it. Until we recognise this difference in values, and give technology its proper place and due reward, we can never make the advances in industry that we ought to make."

"I always refuse," Professor Louis added, "to recognise any border line between pure science and applied science. That is to say, I maintain that a man is of no use in applied science unless he has mastered his pure science thoroughly. As an instance of how purely scientific industries may benefit industries apparently unconnected with them, I pointed out last year that Dewar's discovery of the vacuum flask led to important improvements in rescue appliances in coal mines which were never in Dewar's mind at the time. You are constantly getting the most striking examples of such developments. There is the case of helium: A few years ago it was only known as an element existing in the sun and unknown in the earth, and now the Americans produce it on such a scale that they can quote for it by the ton. That is an example of absolutely pure science research of the most recondite character now being actually applied to purely technical purposes."

### The Need of To-day.

"The general need to-day is a sound training in pure science, first and foremost, and then efficient instruction as to how that pure science should be applied in technology. I differ from many people on one point: I do not lay as much stress as many of them do on research. I do not believe in scientific research unless it is done by a really first-rate man who has already had a fair amount of technical experience or is associated with those who have it. The man capable of this sort of research is very exceptional. The man who can do a useful bit of technical research when he knows exactly what he wants to be at in technology is much more plentiful, but you cannot expect every day to find a Dewar or a Ramsay."

"I am, however," Professor Louis said with emphasis,

"absolutely with you as to the great importance of bringing home to the scientific man the use that his science may be to industry, and to the manufacturer the use that pure science can be to him. Both want educating on this point, but perhaps the manufacturer even more than the scientist."

Turning to the standard of scientific teaching in this country, it was satisfactory to have from Professor Louis so good an opinion. "The state of scientific teaching in this country," he said, "I have always maintained is far ahead of what it is in Germany or anywhere else, especially in scientific technology. As regards our methods of teaching we have nothing to learn. I have maintained that view for many years, and this war has proved its correctness. We have applied our scientific knowledge to war work for not quite five years, but in that short time we have outstripped the Germans at every point."

### The Future.

"The future of this country," said Professor Louis, "lies not with the manufacturer or with the scientist; it is in the hands of the working man. Our manufacturers are quite able to hold their own; our scientific men are able to hold their own; our working men can also do so, but only if they choose. If the working man gets it into his head that he can increase his own prosperity and the prosperity of the nation by doing less work, he will yet bring us all to ruin. The demand for ever shorter hours and the deliberate restriction of output are two of the most serious problems before us. I am not at all afraid of higher wages. The wages paid to-day in this country are not much, if any, higher than those paid in America before the war. The difference is that the American working man really earns them."

"At a recent meeting in the Guildhall I could not help reflecting on what those old trades guilds had done to develop the industries of this country. They were thoroughly democratic institutions, and they may be fairly said to have built up the industrial supremacy of this country, and were the ancestors of our modern trade unions. But there is one point of sharp contrast between the attitude of the old Trade Guild and that of the modern Trade Union. The Guild fined a man if he did too little work; the Trade Union fines him if he does too much. The latter attitude is thoroughly false and uneconomic; it is equally bad for the *morale* of the man and for the welfare of the country. The remedy here, as elsewhere, lies in educating the workman to see that if the progress of mankind is to be maintained, he, like the scientist and the manufacturer and everyone else, must make his best contribution to that end by producing the most and the best of which he is capable. We have done wonders during the war because all classes gave themselves freely to work and put aside for the time the insane policy of restricting output. If our triumphs in peace are to equal our triumphs in war, all of us must continue to work together in the same spirit."

## Annual Meetings of the Society of Chemical Industry

THE programme of these important meetings and conferences is now in the hands of the majority of our readers, and under our "Calendar" we print a brief summary. It is fitting that the first annual meeting of the Society during the Reconstruction period should be held in London and on a scale commensurate with the present status, and particularly with the war record of the chemical industry.

The Conference on the Inter-Allied Chemical Federation, in the shaping of which the British representatives played a prominent part at the Paris meeting, naturally comes first. The "Entente Chimique," of which preliminary details were given in the Society's Journal on April 30th, is certain to be realised. While the process of constituting it and formulating its activities is necessarily slow, it is to be hoped that after this international conference, further valuable and concrete decisions will be made public.

"Empire Sugar Production" immediately grips the imagination, and the publications in this connection promise to be of the greatest importance. The bulk of our sugar used to be exported from Germany or other European countries, and later on from Cuba, &c., so that the possibility of obtaining our supplies within the Empire is of national interest.

On July 16th the Chemical Engineering Group holds its first conference—"Power Plant in Chemical Works." The "subject group" system is a new departure, which is certain to be developed in the future, and judging by its vigorous and businesslike propaganda and literature and a membership of over 500, the first "group" is an assured success.

The other conferences all deal with industries of primary importance, that on "Chrome Tanning" being, perhaps, of special interest, as London is one of the homes of the leather industry. In a week or two, when the veil is removed, we hope to be able to stimulate interest in all these conferences; but, of course, little can be made public until the details are settled.

In our interview with the President, which appears in this issue, Professor Louis rightly lays stress on the invaluable help which the Society, its members, and its Journal, have directly and indirectly rendered to the State during the war, and it is, therefore, not surprising that the Society should be in a sound and flourishing condition. Its membership at the end of 1917 was about 4,600, and this had increased to about 5,300 by the end of 1918. Although these numbers are impressive it is clear that there are still very many public men, manufacturers, chemists, chemical engineers, who ought to be readers of the Society's Journal and of its other publications. No doubt the war is partly responsible for the increasing influx of members, and new departures by way of propaganda and advertisement may be both necessary and desirable to maintain this increase in the future.

In addition to the Journal, of over 1,600 pages annually, the Society publishes Annual Reports of Applied Chemistry, the 1918 volume of which is reviewed on another page of this issue.

It is refreshing to note that coincident with the removal of other "War Restrictions," ladies are again welcomed. The social centre of the meeting will probably be the Clinical Industry Club, at 2, Whitehall Court, which is giving temporary honorary membership, providing bedrooms, and serving tea daily to members of the Society and their lady friends. No visits to works in or near London have been arranged, but we feel sure that this is not because manufacturers were unwilling to admit visitors. A policy of secrecy was at one time almost traditional in the chemical trade, and was by no means the prerogative of London firms. War conditions have accelerated the gradual disappearance of this policy and have encouraged the interchange of information and experience. The Society and its Journal have done much to assist this process.

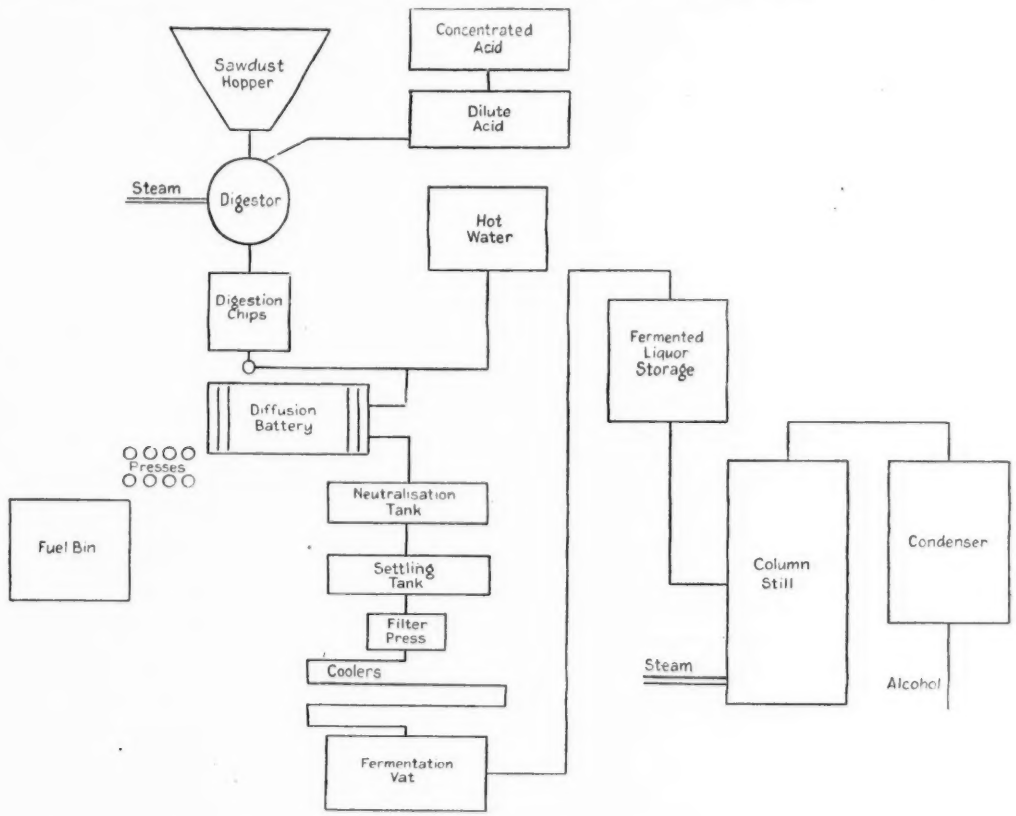
# Notes on the Production of Synthetic Alcohol

By Dr. E. K. RIDEAL, M.B.E., M.A., F.I.C.

*Dr. Eric Rideal has been connected during the war with the Munitions Inventions Department, and has been in intimate touch with much of the industrial research work which has been carried out by that Department. In view of the suggestions that the problem of a home supply of motor fuel would most readily be solved by a benzol-alcohol mixture, his article dealing with the potential sources of alcohol is of immediate interest.*

WITH the post war programme of reconstruction now fully before us it is evident that the demand for industrial alcohol will increase, not steadily as in the past, but with a new impetus. This stimulus towards greater productivity is not only occasioned by the decision of our chemical manufacturers to be economically independent of foreign supplies of fine chemicals, such as drugs and dyes, chiefly obtained from Germany and Switzerland before the war, but is also due to a world shortage of petrols accentuated by the demands of the aeroplane industry for high grade spirit. The problem of a synthetic alcohol industry for the production of internal combustion engine fuel in our plans for motor lorry services, for the fine chemical industry in which plentiful supplies of this solvent are absolutely essential, and as a national asset, ready in cases of war emergency to produce sufficient alcohol for the sudden requirements of a gigantic explosive output, is thus one which affects, to a greater or less degree, all branches of our corporate life.

Alcohol is, at the present time, almost exclusively derived by fermentative processes from potential foodstuffs. In England we sacrifice one of the most valuable foodstuffs, namely, grain, whereas in Germany a more economic solution has been found in the utilisation of potatoes, an industry which should thrive in England and more especially in Ireland, whilst in the United States maize or Indian corn is chiefly employed. With a shortage of foodstuffs and the relatively small acreage available in the British Isles our attention must be directed towards non-edible materials or to by-products from some industry as our raw material. With the stimulus applied to the production of sugar within the Empire, an increase in the molasses output from the cane sugar factories is to be anticipated and a small, but constant, source of alcohol is to be expected from these sources.




More important, however, is the possible utilisation of wood cellulose as raw material. The hydrolytic conversion of wood cellulose into alcohol has frequently been attempted on a technical scale, but it is only recently that the process has been sufficiently developed to be a commercial success.

The process is in reality conducted in two stages. In the first, the wood cellulose is submitted to hydrolysis, using acids as catalytic agents, by which the cellulose is partly converted into glucose, pentosans, and other fermentable sugars. In the second, the sugars thus obtained are made to undergo fermentation into carbon dioxide and alcohol in accordance with standard practice, with a four days' fermentation period, the alcohol being subsequently recovered by distillation and rectification.

The processes suggested for the hydrolysis of the wood cellulose may be classified in two distinct groups—those in which the cellulose is first dissolved in concentrated acid,

hydrolysis being effected on subsequent dilution; and those in which dilute mineral acids are employed as catalysing agents. As an example of the first type a French patent may be cited, which suggests treatment of wood cellulose with 95 per cent. sulphuric acid for twenty minutes, followed by dilution to 1 per cent. acid strength and digested for a period of one to five hours, when, it is stated, a high conversion to fermentable sugars results. It is evident that the process in this form would not be economically successful owing to the large acid consumption, although by utilising a volatile acid, such as sulphurous or hydrochloric, recovery by distillation could be substituted for dilution and loss, with a corresponding increase in economy. Much more attention has been paid to the dilute acid process, and, according to Tomlinson (Convention of Canadian Chemists, Ottawa, 1918), the process, as developed in the United States along these lines, is now established on an economic basis.

Simonson (*Z. Ang. Chem.*, 1898, 195) appears to be the first to have utilised dilute mineral acids under pressure as hydrolytic agents, the idea being developed by A. C. Classen at Aix la Chapelle, who found sulphurous acid to be one of the most effective catalysts. Solution of the wood fibre in large volumes of dilute acid entailed a big fuel consumption for subsequent concentration and rectification, as well as difficulties due to handling large volumes of material for a relatively small output. According to A. W. Kressman, of the U.S. Forest Products Laboratory, the problem was solved by keeping the wood fibre sufficiently dry during hydrolysis to be handled by mechanical conveyors. The original sawdust would take up an equal weight of a 1 per cent. solution of sulphur dioxide without becoming too fluid for the conveyor. A general lay-out of such a factory is shown in the accompanying diagram. In actual operation the moist sawdust is heated by means of superheated steam, and hydrolysis effected at from 75 to 100 lb. pressure. The soluble sugars are subsequently extracted by means of diffusion batteries, such as are used for the beet sugar industry, but in this case provided with acid-proof linings. The aqueous solution containing the sugars is neutralised with milk of lime and subjected to the usual four-days' fermentation process, the alcohol being recovered by distillation and rectification. The moist, insoluble wood fibre has a small calorific value as fuel, for which purpose it is generally employed, but a more profitable utilisation of this by-product —*e.g.*, for paper or papier maché—is one of the pressing needs of the industry.

The utilisation, as a source of alcohol, of the sulphite waste from paper and pulp mills has during the last decade received increasing attention, especially in Germany, but, owing to the enormous dilution of the raw material available, no economic scheme has yet emerged, except in Scandinavia, where supplies of very cheap power are available. As regards yields, about 80 gallons of proof spirit are obtainable from a ton of corn; on a laboratory scale some 35 gallons are recoverable from a ton of dry wood, but in actual manufacturing practice only some 20 gallons per ton of dry wood are obtained. It is obvious, therefore, that the capital outlay on a plant for the production of alcohol from wood will be somewhat larger than that for an equivalent output from starch, although this extra expense is only entailed in equipment for the preliminary hydrolysis of wood to soluble sugars, the subsequent fermenting vats and rectification plant being identical in the two cases. The estimated cost of conversion of starch or wood into alcohol is stated to be in the neighbourhood of 1s. per gallon.

Of an entirely different character are the chemical methods proposed for the production of synthetic alcohol, viz., the acetylene and the ethylene processes, of which the former is said to be already established on an industrial scale at the Hoechst Farbewerken in Germany, at Visp in Switzerland, and on a small scale in England.

In the acetylene process, acetylene obtained from calcium carbide is first converted into acetaldehyde by a process of catalytic hydration, and subsequently reduced to alcohol by hydrogenation, the first reaction taking the following course :—

$$CH : CH + H_2O \rightarrow CH_2 : CHOH \rightarrow CH_3CHO.$$

The patent literature covering the catalytic methods of bringing about a rapid and quantitative hydration of acetylene is extremely large. In general practice acetylene gas and water are led at regulated rates into a warm liquid medium, usually maintained at 80° to 90° C., containing solutions or suspension of a metallic salt as catalytic material, the acetaldehyde being removed as fast as it is formed by distillation.

As solvent, glacial acetic acid is generally employed, but 20 to 25 per cent. sulphuric acid, 30 to 35 per cent. phosphoric acid, organic sulphonic acids, sulphuric acid, with the addition of the salts of weak acids—*e.g.*, a borate—and acetone have all been proposed. The metallic salt employed as catalyst is invariably a mercury salt, with or without the addition of other salts, such as ferric sulphate or chromic acid, which, it is claimed, function as promotors. Finely divided metallic mercury, in suspension in an acid medium, has likewise been suggested.

Attempts, so far unsuccessful, have likewise been made to carry out the process above 100° C., so that acetylene and steam may be utilised, being passed through a layer of granulated catalytic material, thus dispensing with liquid media. The volatility of mercury and its salts in the gas, however, is a serious drawback to this method of operation, although it is claimed that good results have been obtained by substituting molybdenum oxide for mercury as catalytic agent.

The second part of the process involves the hydrogenation of the acetaldehyde to ethyl alcohol, which reaction is a reversible one—

$$CH_3CHO + H_2 \rightleftarrows CH_3CH_2OH.$$

*Hydrogenation of the aldehyde, accomplished by passing* the dry mixed gases over finely divided reduced nickel supported on suitable material, proceeds rapidly at 140° to 180° C., when 80 per cent. conversion is obtained by a single passage. With increasing temperatures the conversion rapidly sinks, and at 250° C. dehydrogenation of the alcohol occurs to such an extent that only 20 per cent. conversion is obtained, hence an accurate temperature control over the whole of the catalyst mass is essential. Metallic copper, which is extremely effective for dehydrogenation, has likewise been tried for the production of the alcohol, but, unless specially prepared, falls far short of finely divided nickel in catalytic activity. The unchanged aldehyde and hydrogen are separated from the alcohol by a simple form of fractionating column, and returned to the converter. As to costs of the acetylene process little is known, but since approximately 20 lb. of good-quality calcium carbide and 85 cubic feet of hydrogen are required per gallon of 100 per cent. alcohol, the cost of the raw materials alone will not be less than 2s. 1d., taking the present conservative estimates of carbide at £10 per ton, and hydrogen at 5s. per 1,000 cubic feet.

Capital charges would, of course, be extremely small, and but little expense would be entailed in operation costs and for replacement and renewal of the catalytic material.

The economic aspect of the ethylene process is much more favourable, provided some suitable process of catalytically accelerating the hydration of ethylene according to the equation

$$CH_2 : CH_2 + H_2O = CH_3CH_2OH$$

is developed, which so far does not appear in any of the published literature.

Potential sources of ethylene are to be found in ordinary

coal gas up to 2 per cent., but more especially in coke-oven gas (2.5 per cent.), of which there are extremely large supplies available. Soddy's method of extraction of the ethylene from the other gaseous constituents appears capable of application on a technical scale. It is based on the fact that ethylene and the other unsaturated hydrocarbons are selectively and readily absorbed by charcoal at ordinary temperature, the ethylene being recovered from the charcoal by heat conveniently attained by passing molten lead through the absorbent mass.

Taking the same value for all the combustible constituents of the gas at 2s. per 1,000 cubic feet, it is evident that the cost of 1,000 cubic feet of ethylene, which is sufficient to provide 14 gallons of alcohol, should be available for this sum, assuming that the remaining gas is used for some industrial purpose after stripping. To this must be added the cost of absorption in beech wood or prepared charcoal, and recovery of the absorbed ethylene by heat.

According to the patent literature there appears to be some hope for the production of ethylene from methane and carbon. Both in England (at Heathfield) and in Wales gas spouters are to be found delivering practically pure methane, which, if convertible by passage over an intimate mixture of carbon and some catalytic agent, as is claimed in the various patents, should prove a most economical source of ethylene. But, as already indicated, the method hinges on the possibility of catalytically accelerating the hydration of ethylene, and although signs of catalytic acceleration have been noted in the laboratory, the problem cannot be considered solved so far as technical operation is concerned.

# Column Apparatus in Chemical Industry.

By SYDNEY J. TUNGAY.

*Mr. Tungay is familiar to the chemical trade in connection with the use and manufacture of acid-resisting iron. The present article deals with some elementary principles regarding the use of towers, columns, and filling materials, and makes special reference to the improved type of distillation and washing column patented by Kubierschky, of which illustrations are given.*

Among the many problems which have to be continually faced by the chemical engineer and the chemical manufacturer, probably there are few of greater importance than the treatment of gases and fumes for the purpose of cooling or washing them with water or liquids, or in connection with the distillation and concentration of chemical liquors and condensation and absorption of gases.

Of all the many types of plant hitherto proposed for carrying out the above processes, an installation in tower or column form is usually the most suitable, although in the past such apparatus has often been defective in design.

In the chemical industry, efforts have for long been made to adopt more extensively forms of column apparatus for distillation, condensation, and absorption, as apparatus of this kind has much to recommend it, on account of simplicity of construction where corrosive gases and liquors have to be dealt with—as in the manufacture and treatment of sulphuric, nitric, hydrochloric and other acids, whilst the additional advantage of comparatively small floor space occupied, further recommends the adoption of plant in tower or column form. There is also a large number of different columns adapted for the condensation, absorption, and recovery of nitrous gases in connection with nitric acid plant, and the ordinary and well-known system of stoneware towers, as adapted to the recovery and absorption of hydrochloric acid. Again, for distillation, the column system of still has been widely applied in the distillation of alcohol, heavy and light oils, petroleum, tar, the extraction of benzol, and for similar processes.

Perhaps the most important points to be kept in mind in deciding upon the dimensions and shape of a column are the volume of gas or liquid to be treated, the working temperatures, the internal resistance that can be allowed, and the nature of the compounds to be dealt with. An absorption column must be so arranged that the greatest possible percentage of soluble gas is absorbed whilst passing through the column. The liquid solution recovered should be as strong as possible.

The usual form of column is constructed on the simple counter-current principle, and arrangements are introduced in the way of packing of filling material to effect as prolonged a contact between the gases and liquids in the tower as is possible with a view to effectively treating one with the other, whether for absorption, washing, or other treatment.

Probably the most simple of all columns are those which are completely empty, and, as in the case of the Gaillard tower, chiefly rely for intimate contact upon the pulverisation or atomisation of the liquid passing from the top through the gases which are rising from the bottom of the column.

It is quite conceivable, even with a column of 100 feet or more in height, that the duration of contact cannot exceed but a few seconds, or in reality the time taken by the falling of the pulverised liquid, and it is to combat this disadvantage and to prolong contact that towers of this description have been constructed to great heights.

Another drawback to such a system of column is that the rising gases, usually very hot, coming into contact with pulverised liquid, are apt to carry a considerable quantity of the liquid in atomised form out of the tower or column altogether.

To overcome these difficulties, many varying forms of packings or fillings have been devised. The points to be borne in mind in connection with such fillings for column apparatus are as follows :—

1. They should be composed of elements of as regular a form as possible.
2. They should offer a large "free space" in comparison with the total volume of the column filled. Further, the internal resistance of the column should be small.
3. The specific gravity of the filling substance should be low.
4. It must resist any attack or corrosion from the gases or liquids in course of re-action.
5. It must not be liable to break up or crumble.
6. Finally, it must be so arranged as to avoid any direct free passage of the gases or liquids, which would allow them to run through the tower without treatment.
7. It must provide for continual change of velocity, so as to ensure a good mixing action.

The form of ring filling for columns devised by Raschig is, perhaps, one of the most satisfactory of all types designed in the past. Thin sheet-iron rings 1 inch diameter and 1 inch long arranged promiscuously will give a scrubbing surface of over 200 square metres per cubic metre of space filled, at the same time leaving an amount of free space (as for example in connection with a benzol recovery column where small rings are used), which may reach even 90 per cent. By using bricks as filling pierced with four holes,

with say 300 bricks per cubic metre, the scrubbing surface is only about 25 square metres, and free space only about 68 per cent.

Whilst small Raschig rings will give such good efficiency, large rings do not answer so well. The large rings, 3 inches diameter by 3 inches long, although of similar shape, will only present a scrubbing surface of about 88 square metres per metre cube of column space, and the free space represents only 73.8 per cent.

A logical development of Raschig's rings are the "Diabolos,"* consisting, as the name indicates, of units formed of two hollow truncated cones joined together at their smaller ends. These units are filled irregularly into the column, in the same manner as Raschig rings. They possess the advantages of continual change of velocity, and a good mixing action, referred to under note 7 above.

Another form of packing shaped like a four-point star, designed by Partington & Parker, is said to show very good results in absorption columns, but although allowing a large percentage of free space, is rather low in scrubbing surface.

Much might be written on the subject of filling and packing devices alone, and there is already much literature on the subject. The writer's present purpose is, however, to deal with the question of column apparatus.

Given a well-proportioned column for distillation or absorption or for the washing of gases, and also a satisfactory type of packing or filling material available, the chemical and physical operation which has to be undergone inside the column requires some study in order to make certain that the latter will be efficient.

In practically all columns liquid trickles down, meeting the gas or vapour in its course, with the result that the greater portion of the gas or vapour is absorbed by liquid trickling down, whilst the vapour or gas that is freed from the portion absorbed passes out at the top of the tower: or the liquid that trickles down is treated by means of a stream of vapour or gas that meets it from below, for the purpose of expelling the soluble vapour or gas from the liquid, or of purifying the liquid from such vapour or gas. In the case of condensation, the process is to effect the cooling of the rising vapour or gas merely by means of liquid trickling down. In the construction, therefore, of a great many columns, the primary essential has often been overlooked.

If gas or vapour is slowly introduced in a column already filled with gas of a different density, the two gases will remain separate, one superposed upon the other, and will not become mixed or diffused, except after more or less lapse of time, just as would happen with two liquids of different densities. This can easily be demonstrated as follows:—

1. Hot air introduced into a column full of cold air will immediately rise to the top and accumulate there.
2. Benzine vapour, being heavier than air, can be transferred from one column to another, and will easily displace the air in the column, which is lighter than itself.
3. If steam is caused to enter into the top of a column filled with air as in Figure 1, whilst the outlet is at the bottom, the steam, being lighter than the air, will extend all over the top part of the column, in the form of a horizontal fog or cloud, whilst the air, over which the steam in a manner floats, will be expelled from the bottom outlet, and it will only be after all the air has been expelled that the steam will in its turn be found to issue from the bottom outlet.
4. On the other hand, if steam is delivered into a column by an opening at the extreme bottom, and the outlet is at the extreme top of the column, as in Figure 2, the steam will rise immediately to the top in the form of a core more or less compact, and will seek to escape by the top opening without disturbing the air in the column, which is heavier than itself.

These very simple and elementary physical principles are often entirely overlooked in column construction, and these principles affect the treatment of gases in column apparatus very materially.

Again, the rising mixture of gases and vapours passing through a tower at one time becomes specifically lighter, at another point specifically heavier, according to the nature of the components. For example, mixtures of air and HCl, $SO_2$, $C_6H_6$, $Cl_2$, $Br_2$ become lighter in the course of absorption, but heavier in the course of distillation, whilst mixtures of air and $NH_3$ become heavier by absorption, as does also aqueous vapour which meets a mixture of alcohol and water. The simple physical explanation is to be found in the respective vapour densities.

A column formed on a somewhat more rational system

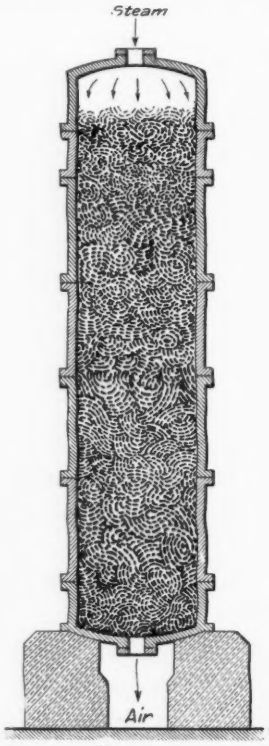



FIG. 1.

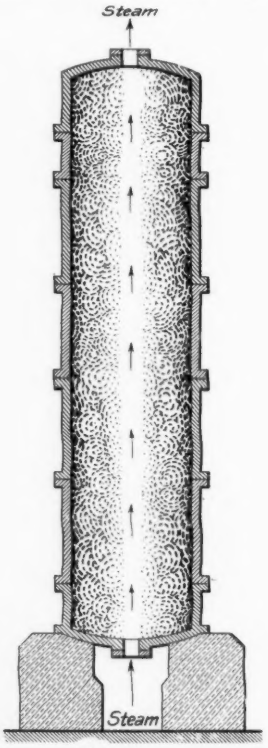



FIG. 2.

is the well-known plate column, introduced by Lunge & Rohrmann in 1886-7 and 1889. This consists of cylindrical or square sections, filled with perforated plates, which form the peculiarity of the invention—the idea being effectively to break up the particles of liquid descending, and to cause the ascending gases to pass through apertures in the different plates. These apertures differ as to position from plate to plate; hence the liquid descending cannot drop straight through the holes in the following plates.

Whilst this type of column has been used to some extent, particularly on the Continent, and contains no packing or filling other than the perforated plates mentioned, yet it does not go far enough as regards meeting the peculiar physical conditions that are needed in an absorption tower.

The fractionating columns as made for benzol recovery and rectification go still one step further than the previously mentioned type, as in the case of the best design of benzol fractionating columns they are built up of cast iron segments, numbering up to about twenty-five, each having

* *British Patent, No. 110,260.*

separate plates with eight or ten passages. Over each of the passages or holes a dome-shaped cast iron cap or hood is placed, forcing the vapours to traverse through the washing liquid during fractionation, thus recognising the principle of the heavy vapour which tends to sink downwards on account of its increased specific gravity.

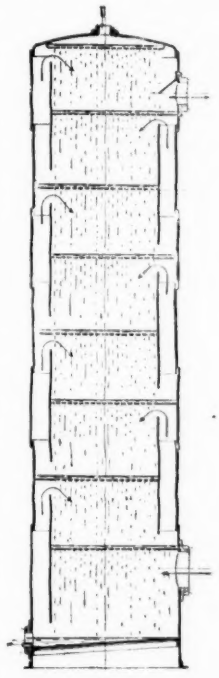


FIG. 3.

Undoubtedly the most scientific in principle of all column apparatus is that designed and patented by Dr. Kubierschky, and in very extensive use on the Continent. Figure 3 shows a Kubierschky column for absorbing gases by means of liquid. The hot gases enter at the lower inlet, and the absorption liquid at the extreme top of column. The column is divided into a series of chambers by means of perforated plates having fine holes, each of these plates sustaining a small depth or layer of liquid.

On the principle that the gases during absorption or condensation become heavier, the gas outlet of each chamber is at its lowest point, and the gases which are not absorbed in the bottom chamber rise from its lowest point to the top of the next chamber. As they become heavier, such as are not absorbed therein again rise to the top of the next chamber, where the process is repeated.

Figure 4 shows a photograph of a large washing column constructed on this system for washing blast furnace gases, which the writer inspected at a blast furnace installation at Bochum, Germany, and which deals with 30,000 cubic metres of gas per hour.

Figure 5 shows a sectional view of this type of column. It will be seen that the furnace gas enters the column in the lowest compartment. The gas, being very hot, tends to rise, but is met with a perforated grid or baffle, through which cooling and washing water is descending.

This cools much of the gas, and its density being thus increased, causes it to fall to the bottom of the first compartment, where it is driven out into the second compartment, and is there again spread out below the washing water. Therefore in every instance the lighter gases are forced against the flow of water from the perforated grids, whilst the heavier gases escape by a passage at the lower part of each compartment, taking them again to the next compartment, placed immediately above, where the same process is repeated.

It will, therefore, be seen from the sectional illustration No. 5, that the gases are separately treated to the flow of cooling or condensing water no less than five times, before being finally delivered from the outlet near the top.

The principal condition to be kept in mind in order that columns of this system may be applicable, is that the density of the gases or mixture of gases, must increase from the base to the summit of the column, and this is the exact physical operation which takes place in most columns used for absorption, condensation, or the washing of gases. In the apparatus shown, the gas originally at 80 degs. C. has been brought down to a temperature of 10 degs. C., by means of water at 10 degs. C.

Bearing in mind that the cooling of these furnace gases is always accompanied with dust recovery Dr. Kubierschky's principle as applied to the purification of blast furnace gases is very valuable. Besides, in a washer of this type the cooling does not take place suddenly, but gradually, from compartment to compartment, and this entirely avoids the formation of a fog, which might be produced in a non-compartment column of such a type as would not necessarily effect the separation of the finer dust.

In the case of the plant inspected by the writer, the greater part of the dust was precipitated in the lowest compartment, but it will be clear that when the treatment of very impure gases has to be undertaken suitable cleaning orifices of practical size would require to be furnished at the bottom of every compartment, so as to facilitate the periodical cleaning of each compartment of the column.

Figure 6 shows another adaptation of the Kubierschky system of column for the distillation of alcohol. This resembles an installation which the writer inspected at the large chemical works of E. Merck at Darmstadt, and which was reported as giving excellent results.

In column apparatus for this class of work, the alcoholic vapour which has to emerge in the purest possible condition is about 2.7 times heavier than the steam with which it is carried off. The lower part of the column from *f* serves as an expulsion column and the part marked *A* as a rectification column.

In *c* is introduced low pressure steam of say about one atmosphere. This steam rises in the column in the way indicated by the arrows, and carries up during its passage the alcohol contained in the alcoholic liquid, which is falling drop by drop through the perforated grids.

The vapours produced then arrive at that part of the column where the rectification takes place, and which is sprinkled by counter-current liquid gravitating down from the cooler *B*

The vapours are washed in this compartment, and as a result are concentrated, and only the vapours rich in alcohol

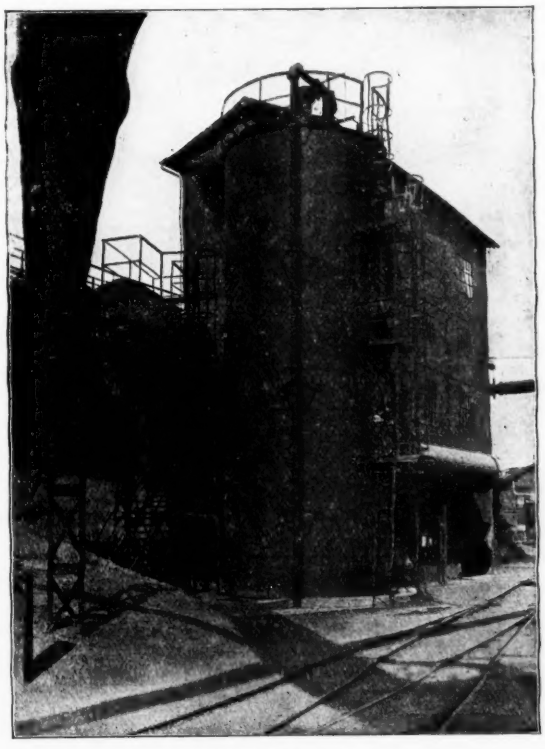


FIG. 4.

pass from the upper part of the column into the cooler *B*. Here a part of the vapour is recondensed, and redescends in the column, whilst the greater part of the rich alcoholic vapours emerge from the column through the outlet *d*, for precipitation as distillate in a condenser. The residue of liquor when entirely freed from alcohol, passes out from the bottom of the column at *b*, at the same temperature as the steam at the inlet. It is, therefore, possible to utilise this in a heat exchanger or dephlegmator, for the purpose of pre-heating the raw liquor.

It has been found that in a simple column apparatus provided only with sixteen rectification chambers, from the first starting up, methyl alcohol has been brought by distillation to 99.2 per cent. of purity.

One point, however, of the highest importance is that with a column apparatus for continuous working, as shown in Figure 6, one should obtain constantly from the start to the end of the operation a condensed product of uniform purity. In addition to this, it was found that the output of

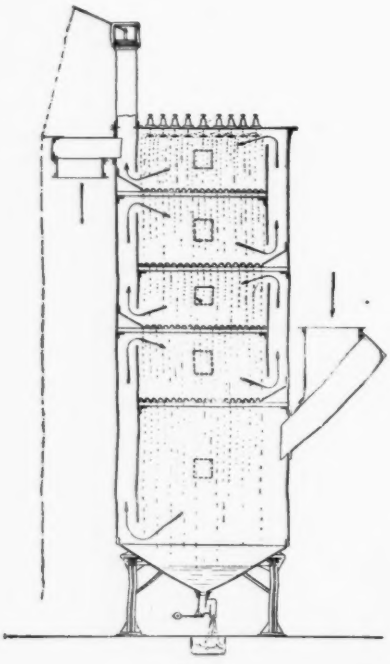


FIG. 5.

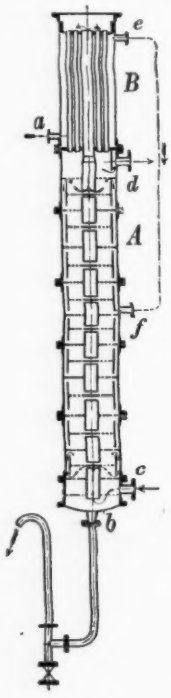



FIG. 6.

the plant could be diminished or adjusted to its minimum when desired, without seriously influencing its method of working.

It will be seen from illustration No. 6 that in this instance the communication passages are placed alternately in the centre of the different chambers of the columns instead of at the sides only as shown in Figure 3. At the same time, the system of a column separated into partitions or chambers is still maintained.

Another very important factor which will be obvious from the arrangement which Dr. Kubierschky adopts is that the *internal resistance of each of these columns is very low*, since the gases are not necessarily forced through an abundance of packing or filling material, but a free passage through the tower is maintained, which considerably exceeds the actual bore of the inlets and outlets. At the same time in order to traverse these inter-communicating passages, the gaseous vapours are compelled to traverse very thoroughly and rapidly the area covered by the counter current of liquid which is descending by gravitation.

# School of Chemistry at Cambridge

(FROM A CORRESPONDENT.)

OXFORD and Cambridge are recognised as the central fountain heads of education in the British Empire. Oxford on the literary and philosophical side, and Cambridge on the scientific and mathematical side, are the tops of our "educational ladder." Thus it is that the most gifted intellects of every generation in this country amongst those whose mind and temperament incline to science will aspire to complete their education at Cambridge. For this reason it is of the utmost national importance that a first rate faculty of science should be maintained at Cambridge, and that the School of Chemistry, one of the fundamental sciences, should be endowed with all that is necessary to make it one of the foremost schools in Europe.

The functions of such a school are—(1) To train specialists in chemistry capable of taking a leading part in furthering the theoretical knowledge of the subject and its practical applications; (2) to give general scientific knowledge to men possessing the other qualities necessary to fit them for business positions in industry; (3) to give to chemistry its place in the higher education of the best intellects of every generation; (4) to carry on chemical research in a manner worthy of a great university and of the traditions of the Cambridge scientific schools.

To enable the school to cope with the rapidly widening range of demands a capital of at least £100,000 is necessary to meet the annual expenditure, and, in addition, a sum of about £100,000 will be needed for buildings and equipment. A capital outlay of £200,000 is thus required to enable the Cambridge chemical laboratory to retain its present leading position.

During coming years the research resources of our great chemical laboratories must undoubtedly be directed more than in the past to the working out of highly scientific problems which bear closely on the chemical industries. Each laboratory will tend to devote itself more particularly to specific industries; this specialisation has already commenced in several English Universities.

The suggestion is that the great petroleum organisations, whose homes are in Great Britain, should signalise the momentous events in which they have played so large and decisive a part during the last five years by endowing the School of Chemistry at Cambridge.

Apart from the service they will thus be rendering to all scientific work in this country, it is hoped that the connection thus established will lead to the School of Chemistry at Cambridge becoming the principal centre of investigation of the problems connected with the petroleum industry.

It may be well to give the terms of the recent offer by the British Oil Companies. These are embodied in the following letter of May 20th, written by Mr. R. Waley Cohen to the Vice-Chancellor :—

"You have already intimated to the Senate the intention of the British Oil Companies to join together in presenting a fund for the endowment and extension of the Chemical School at Cambridge, and I have now the pleasure to convey their offer formally to you. The Burmah Oil Co., the Anglo-Persian Oil Co., and the Anglo-Saxon Petroleum Co., have each decided to contribute £50,000, Lord Cowdray and the Hon. Clive Pearson together £50,000, and Mr. H. W. A. Deterding a further sum of £10,000, making a total amount of £210,000 which the donors desire to present to the University for the benefit of its School of Chemistry. It is understood that not more than one half of the sum will be devoted to the extension of the present Chemical Laboratory, and that the remainder will be utilised for supplementing the funds at present available for the upkeep of the laboratories and for the payment of the teaching and research staff of the Chemical Laboratory."

# Oil Production in England

## Analyses of the Hardstoft Product

THE authorities who assure us we have "struck oil in England" cautiously add that everything turns on the quantity produced. From Archdeacon Crosse's letter the other day in the *Times* one might imagine that the valleys of Derbyshire were already running with oil, and that the parish church of Chesterfield, with its famous twisted spire, was soon to become the Cathedral of another Baku. The oil-boring experiments now going on in Derbyshire are, of course, of great interest, but on the results obtained up to the present it would be foolish to base extravagant expectations.

It may be interesting, however, to give a short account of the oil drilling operations now being carried out on behalf of the Government, with what is much more important—analyses of the oil obtained. The work hitherto undertaken by the Mineral Oil Production Department in connection with drilling for oil in Great Britain has recently been transferred to H.M. Petroleum Executive. The Petroleum Executive will act on behalf of the Minister of Munitions in all matters affecting the administration of the work, while the actual operations will continue to be conducted by Messrs. S. Pearson & Son as Petroleum Development Managers.

In all, eleven drilling sites have been selected—seven in Derbyshire, two in North Staffordshire, and two in the Midlothian district of Scotland. The sites for all of these wells have been selected after very careful geological research, for the purpose of testing those geological structures which are regarded as being the most favourable for the conservation of any petroleum which may exist.

### The Derbyshire Wells.

The wells in this area start in the coal measures strata and will be carried through the Millstone Grits into the carboniferous limestone which lies at a probable depth of some 3,000 to 3,500 ft. The positions of the seven wells are as follow, starting from the north:—

*Ridgeway:* West of the village of Ridgeway, 2½ miles north-west of Eckington.

*Renishaw:* One mile south of the village of Eckington.

*Brimington:* Recreation ground belonging to the Brimington Parish Council halt a mile south of the village of Brimington.

*Heath:* In close proximity to the village of Heath.

*Hardstoft:* On Biggan Farm, near Hardstoft, one mile north of the village of Tibshelf.

*Ironville No. 2:* Two and a-half miles north-east of the village of Ironville.

*Ironville No. 1:* Half a mile south-west of Ironville village.

RIDGEWAY WELL.—This well was commenced on April 5, 1919, but delay occurred on account of the necessity of waiting, for experienced drillers. The work is now progressing, the depth being at the present moment 370 ft.

RENISHAW WELL.—This well was "spudded in" on January 18, 1919, and by February 6 a depth of 530 ft. had been reached. The 15½ in. casing was set at this depth and cemented to protect the deep hard coal seam which was passed through. The 12½ in. casing was landed at 599 ft., the water being effectively shut off down to this depth. A sand with dry gas was passed through at 1,610 ft., followed by another sand containing wet gas. At this horizon a very slight show of oil was noted. As water was encountered below the gas, the 10 in. casing was run to 1,785 ft. and the gas and water successfully mudded off. The present depth of the well is 2,950 ft.

BRIMINGTON WELL.—At this well, where drilling was commenced on November 29, 1918, water was encountered, with the result that the 15½ in. casing was set and cemented at a depth of 222 ft. Drilling was resumed on January 2, and at 1,030 ft. a sandstone, apparently the rough rock of the millstone grit, which also contained water, was drilled into. As the drilling progressed to 1,070 ft., sufficient gas began to appear to make the water flow over the top of the casing. The well was carried to 1,106 ft., when it was considered necessary to mud off the water and gas. Some delay resulted, but this work was successfully accomplished and drilling was resumed on March 17. At a depth of 1,285 ft. the gas pressure caused the collapse of a portion of the 12½ in. casing. A little gas and a trace of oil was noted in the Chatsworth grits at 1,430 ft. The 10 in. casing was set at 1,785 ft. The grit beds of the millstone grits appear to be normally developed, and the well has now reached a depth of 2,625 ft.

HEATH WELL.—Drilling operations started on February 27, 1919. A worked-out and unrecorded coal seam was encountered at 17 to 25 ft. below the surface; this had the effect of rendering the derrick unsafe and necessitated underpinning the derrick with concrete pillars. Water and clay were met with below the old coal working, and as the hole showed a tendency to cave, it was considered advisable to put in 55 ft. of 20 in. casing, which was cemented to shut off the water and prevent further caving. Drilling was resumed on March 14 from the depth of 55 ft., and has now reached a depth of 1,190 ft. At 280 ft. a thin sandstone was passed through which carried a small amount of gas.

HARDSTOFT WELL.—Drilling operations on this well were officially started by the Marquis of Hartington on October 15, 1918. At a depth of 527 ft. the 15½ in. casing was cemented in order to protect the coal seams which had been penetrated. On resumption of drilling the 12½ in. casing was carried to 1,036 ft., at which depth it was cemented to protect the Kilburn coal seam. The strata passed through consisted of sandstones and shales, and the usual coal seams common to the district. The Wingfield sandstone occurred at 900–990 ft., consisting of alternations of sandstone and shale with salt water. From 1,400–1,513 ft. alternations of sandstone and shale, with water, a little gas and a slight show of oil were encountered, and at a depth of 3,377 ft. oil was met with. It is impossible to make a definite statement as to the exact geological horizon at which the oil was found until the well has been carried deeper and further samples of the strata obtained. The oil-bearing horizon had been penetrated only a few inches when operations were suspended to repair the calf wheel of the derrick and to take suitable precautions for dealing with the oil. The oil at present is flowing into the borehole at the rate of about 350 ft. per day, and a column of oil now stands in the borehole to a height of 2,500 ft.

IRONVILLE NO. 2 WELL.—Drilling operations commenced on January 29, 1919, and on March 2 a depth of 543 ft. was attained, shortage of water having occasioned a slight delay. The 15½ in. casing was cemented at this depth to protect the coal seams, and the 12½ in. casing was cemented at 794 ft. The present depth of the well is 1,990 ft.

IRONVILLE NO. 1 WELL.—Although this well was "spudded in" on February 13, owing to certain unavoidable delays it was not found possible to start effective drilling operations until March 3, at which date the well was 55 ft. deep. Progress was, somewhat slow owing to the soft shales and clays encountered, as well as the quantity of water which was met with in the strata. The 15½ in. casing has been carried to 246 ft. and the water effectively shut off. The well has now reached a depth of 1,460 ft.

### North Staffordshire.

Two sites have been chosen in this area—one at Apedale, and the other at Werrington. At Apedale the work of cementing off certain worked-out coal seams has been completed, and the surface water shut off. The well is now drilling at 265 ft. The Werrington well was commenced on April 23, but the work was temporarily suspended owing to the necessity for making certain repairs to the boiler. Drilling has recommenced, and a depth of 350 ft. has been reached.

### Scotland.

Sites for two wells have been selected in the Midlothian district (1) D'Arcy, situated about three miles south-east of Dalkeith, and (2) West Calder, close to the village of West Calder. Drilling has not actually commenced at these boreholes, although the work of rigging up at West Calder is well advanced.

As is well known, Messrs. Pearson & Son, Ltd., have during the past few years carried out extensive investigations into the oil possibilities of Great Britain, and have placed at the disposal of the Government the results of these investigations, together with the experience and assistance of their technical staff. The results so far attained at Hardstoft have been very largely due to the technical work carried out by Dr. A. C. Veatch, Lord Cow-

dray's chief geologist, who has been assisted by Mr. Crandall and Mr. Ickes. The chemical investigation carried out by Mr. J. E. Hackford, chemist to Messrs. Pearson, has added materially to the evidence which led to the test by the drill.

### Analyses of Samples.

A sample of the oil from Hardstoft was analysed by the late Sir Boverton Redwood, the Director of Technical Investigations, H.M. Petroleum Executive, who submitted the following report —

"The sample of crude petroleum from well No. 1 Hardstoft, Derbyshire, which was handed to me for examination, furnishes the following results :—

"*General Character.*—A limpid oil of dark brown colour by transmitted light, but exhibiting strongly-marked green fluorescence by reflected light, and of characteristic odour. The oil contained only a trace of water.

| | | |
|---|---|---|
| Specific Gravity at 60°F. | 0.828 | |
| Flash Point (Abel Test) | 73°F. | |
| Distilling below 150°C. (Petroleum Spirit) | 4.5% | By volume |
| Distilling between 150°C. and 300°C. (Petroleum lamp-oil or kerosene) | 41.0% | |
| Specific Gravity at 60°F. | 0.783 | |
| Flash Point (close test) | 105°F. | |

"*Residue* ceases to flow at 45°F., owing to the presence of solid hydrocarbons (paraffin).

"Further examination of the sample including the determination of the percentage of sulphur is in progress. It is obvious that this is a true natural paraffin-base petroleum of excellent quality. I am of opinion that in practice 9 or 10 per cent. of motor spirit could be obtained from such crude oil. The yield of kerosene might also be largely increased."

A further analysis has been made by Mr. J. E. Hackford indicating the commercial products obtainable from the oil :—

| | |
|---|---|
| Motor Spirit | 7½% |
| Kerosene (lamp oil) | 39% |
| Gas Oil (basis of fuel oils) | 20% |
| Lubricating Oils | 30.5% |
| Paraffin Wax | 3% |
| Sulphur | 0.26% |
| Specific Gravity | .823 |
| Setting Point | 0°F. |
| Viscosity (at 100°F. Redwood) | 48 secs. |
| Chemical Characteristics | Paraffin base containing naphthenes |

It is interesting to recall the fact that as far back as November, 1915, Dr. J. E. Hackford, when carrying on investigations with regard to oil seepages in this country in relation to geological formation, predicted what the approximate analysis of any oil which might be struck in depth in this country would be. How near his estimate coincided with the actual analysis of the oil obtained from the Hardstoft well at a depth of 3,075 ft. may be judged from the following comparison :—

| | Estimated Composition. | Analysis of Hardstoft. |
|---|---|---|
| Motor Spirit | 5% to 10% | 7½% |
| Kerosene | 40% ,, 50% | 39% |
| Gas Oil | 15% ,, 50% | 20% |
| Lubricating Oils | 14% ,, 32% | 30.5% |
| Paraffin Wax | 5% ,, | 3% |
| Sulphur | 0.3% ,, 0.5% | 0.26% |
| Specific Gravity | .860 ,, .890 | .823 |
| Setting Point | Below 0°F. | 0°F. |
| Viscosity | 55 secs. | 48 secs. |
| Chemical Characteristics | Paraffin base containing Naphthene. | Paraffin base containing Naphthene. |

From the analysis it will be seen (a correspondent writes) that the oil is particularly rich in kerosene and intermediate oils and there is no doubt that on this account a much higher percentage of motor spirit could readily be obtained by "cracking." From all accounts it would be a particularly easy crude oil to refine.

In the following table a comparison is made of the average oils obtained from Pennsylvania and three of the principal Californian fields :—

| | Pennsylvania. | California. | | |
|---|---|---|---|---|
| | | Coalinga. | PicoCanon. | Puenta. |
| Specific Gravity | .798 | .862 | .844 | .880 |
| Petrol and Benzine | 21.2 | 19.11 | 15.0 | 12.5 |
| Kerosene | 68.1 | 57.72 | 45.0 | 22.0 |
| Lubricating Oil | 5.4 | 3.68 | — | — |
| Paraffin Wax | — | 3.54 | — | — |
| Intermediate and Lubricating Oils | — | — | 32.0 | 42.6 |

The Pennsylvania crude oil shown in the above table is probably the lightest crude oil obtained in the world, whereas in the Californian fields the oil has a higher specific gravity than the Hardstoft oil, and in the case of the Puenta field it will be seen that in a general way the oil is not so rich in light products.

### Licence to Bore in Nottinghamshire.

A licence, dated May 12th, has been granted by the Minister of Munitions to Oilfields of England, Ltd., Worcester House, Walbrook, to bore for petroleum near Newark, in the County of Nottingham. This licence, which is to run for two years, provides that within six months the licensee shall proceed to search and bore for petroleum, and reserves to the Government the right of acquiring the workings and plant at a price to be determined in default of agreement by arbitration.

## Royalties and Excess Profits Duty

The case of the Commissioners of Inland Revenue *v.* Marine Steam Turbine Co., Ltd., decided in the High Court of Justice on Wednesday, raised the question whether a company which had been formed to work certain patents, but had ceased to work those patents, and had transferred its rights to a new company for a royalty, was liable to excess profits duty on the royalties received by it. The respondent company was formed to complete and test the marine turbine engine invented and patented by Sir Charles Parsons, and to demonstrate the possibility of application to ocean-going ships. In January, 1894, the company agreed to take over and work Sir C. Parson's inventions and to pay him a royalty of 2s. 6d. per effective horse-power on every machine sold. A licence in pursuance of this agreement was granted by Sir C. Parsons to the company on December 4th, 1894. Mr. Justice Rowlatt dismissed the Crown's appeal with costs. The effect of his judgment is that a company which has been formed to work patents, but has disposed of them and is continuing in existence merely to draw royalties is not carrying on a trade or business within the meaning of the Finance (No. 2) Act, 1915, Part III., and is, therefore, not liable to the excess profits duty.

## Methods of Colliery Shaft Sinking

An account of the methods adopted in sinking the shafts at the Chislet Colliery in Kent, is given by Mr. Edmund L. Hann, of the Powell Duffryn Steam Coal Co., in an article appearing in the June number of *The Times Engineering Supplement*, published yesterday. The conditions were rendered very difficult by the presence of a bed of running sand, and there was the further complication, that, owing to the danger of subsidence, the construction of engine-house foundations or any heavy permanent buildings was regarded as extremely hazardous until the shafts had passed through this portion of the sinking. The freezing and compressed air processes were both rejected on the score of expense, and it was decided to proceed by using a ferro-concrete cylinder with a cutting edge, and to rely on the weight of the cylinder and added weights to force it through the sand, instead of on the hydraulic jacks employed in two notable cases in which this method had previously been adopted. Another interesting feature of the work, which was successfully completed, was the injection of hundreds of tons of cement in order to consolidate the soft ground.

## References to Current Literature.

*These references are arranged in practically the same technical order under each geographical subdivision. It is hoped to furnish weekly a digest of articles worth reading, and to do so in some cases only two or three days after publication or receipt. We thus hope to save our readers time and trouble, and to stimulate their interest; in return we invite their suggestions and criticisms. These references are purposely made as brief as possible; the original journals are nearly all available at the Patent Office or Chemical Society's Libraries. A list of journals regularly consulted and of the standard abbreviations used will be published at suitable intervals.*

### British.

ANALYSIS. Refractometry and its applications in technical analysis (Papers and discussions at London Section Meetings). *J.S.C.I.*, June 16, 139T-150T.

COAL. Coal Output, 1919-20. Official Estimates. *Board of Trade J.*, June 12, 746.

COMMERCIAL. German Chemical Companies' results. *Chem. Trade J.*, June 14, 520.

GAS. The true principles of Coal Carbonising. *Gas World*, June 14, 507.

The utilisation of Gaseous Fuel in Commercial Practice. F. W. Epworth. *Gas J.*, June 17, 755-759. A general *résumé* which won Sir R. Hadfield's £100 prize.

PAINTS. Paint pigments; their history and development. S. J. Cook, *J.S.C.I.*, June 16, 137T.

PATENTS. Enemy Chemical Patents in the United States. *J.S.C.I.*, June 16, 197R.

POTASH. The passing of the American Potash Famine. P. G. H. Boswell, *J.S.C.I.*, June 16, 198R.

STEEL. Welding mild steel. H. M. Hobart. *Engineering*, June 13, 782.

The bearing of chemical composition and its accurate determination on iron and steel trades. C. H. Ridsdale. *J.S.C.I.*, June 16, 200R.

### Colonial.

OILS. Methods and Machinery for the Extraction of oil from seeds, &c. B. J. Eaton. *Agric. Bull. Fed. Malay States*, Jan., Feb., 1-12.

ORGANISATION. Industrial co-operation. W. R. Ingalls. *Bull. Canad. Min. Inst.*, May, 463-480.

International co-operation of Technical Societies. E. B. Kirby. *Bull. Canad. Min. Inst.*, May, 480-483.

TRADE. Annual Report on the Trade of Canada for 1918. F. W. Field, H.M. Trade Commissioner, Toronto.

### French.

BOILERS. Les Eaux dans l'alimentation des Chaudières. J. H. Mathieu. *Rev. Prod. Chim.*, May 15, 225-228.

BOILER. Boiler feed waters. J. H. Mathieu. *Rev. Prod. Chim.*, May 15, 225-228.

### American.

CHEMICAL ENGINEERING.—Chemical Specifications. W. P. Cohoe. *Chem. and Met. Eng.*, May 15, 539-540. Gives instances of trade specifications for various chemicals.

Modern training of the Chemical Engineer. Abstract of paper by R. H. McKee, Professor of Chemical Engineering at Columbia University.

Some Wild Engineering I have known. D. Wesson. *Chem. and Met. Eng.*, May 15, 512-513. Extract from paper read before American Institute of Chemical Engineers.

NITROGEN FIXATION. The War and the Nitrogen Industry. W. S. Landis. *Trans. Amer. Electrochem. Soc.*, 1918, 195-209.

How the Nitrogen Problem has been solved. Part III. Absorption of Nitrogen by Carbides: the Cyanamide Process. H. J. M. Creighton. *J. Franklin Inst.*, May, 599-610.

Oxidation of Ammonia. *Chem. and Met. Engineering*, May 15, 502-503. Description of the new "Converter" used at U.S. Govt. Nitrate Plant.

RESEARCH. Photography in research. A. G. Eldridge. *Chem. and Met. Eng.*, May 15, 506-510. A useful illustrated Review of the applications of photography in Industry.

RUST PROOFING. Metallic Coatings for rust-proofing iron and steel. Part 2. H. S. Rawdon, M. A. Grossman, and A. N. Finn. *Chem. and Met. Eng.*, May 1 and 15, 458-464, 530-537. Deals with nature of corrosions and gives description and comparative value of methods of testing coatings, especially zinc.

STEEL. The future of electric steel. J. A. Mathews. *Trans. Amer. Electrochem. Soc.*, 1918, 167-178.

### German and Austrian.

COAL. Rational Utilisation of Coal. N. Caro. *Chem. Zeit.*, May 17, 281-283.

FURNACES. A new non-crucible melting furnace. H. Rhode. *Chem. Zeit.*, May 22, 295.

ORGANISATION. Economic trouble, class wars and emigration. C. Hartung. *Z. Angew. Chem.*, May 27, 165-168.

The Socialisation of and supply of raw materials for the chemical industry. Von Artl. *Oesterr. Chem. Zeit.*, April 15, 52-53.

PLANT. Developments in plant for the inorganic chemical industry during the war. *Chem. Zeit.*, May 15 and 22, 273-275, 293-294.

PRODUCER GAS. Uses of the analyses of exhaust gases from producer gas plants and suction gas engines. W. Ostwald. *Stahl u. Eisen*, June 5, 625-626.

## Oil and Colour Chemists

### Mr. A. G. Bawtree's Theories of Colour.

THE monthly meeting of the Oil and Colour Chemists' Association was held in the rooms of the Royal Photographic Society, Russell Square, London, on Thursday, June 12th, when Mr. A. E. Bawtree (of Messrs. G. H. Hatfield, paint and varnish manufacturers, of Mitcham) read a paper on "Colour."

Mr. Bawtree divided his paper into three sections. In the first, he explained the elementary principles underlying the phenomena of colour, and incidentally noted what he described as some rather revolutionary ideas which, he contended, considerably simplified the understanding of colour both from the theoretical point of view and in the practical everyday workshop experience of colour; secondly, he indicated how these ideas were borne out in the practical experience of the colour mixer and decorator; and thirdly, he exhibited a new instrument of his own design for analysing colour, which he put forward as assisting to a better understanding of the principles of colour matching and colour standardisation, and making them much simpler than they are at present.

Leaving aside the elementary principles, the foundation of the author's argument was that the three real primary colours are scarlet, green and blue, and a number of experiments were carried out in connection with the first part of the paper to demonstrate this. As further evidence, it was pointed out that these three colours are the ones depended upon in the natural colour photographic process using Lumière plates. Particularly the author wished to emphasise the point that yellow is not a primary colour. He laid it down that it is an error to suppose, as many colourmen do, that the mixing of pigments and the mixing of coloured light are not separate and distinct things. That, he contended, was an error made in all text-books on the subject of colour, and it would have to be done away with if any real progress was to be made in the mixing of colour. If colourmen would thoroughly make up their minds to speak of their goods as pigments or dyes or inks—anything but colour—and reserve the use of the word "colour" for its proper purposes, it would save a great deal of confusion which arose through its use. He strongly urged the cultivation of the sense of what is really happening in the responding of different bodies to different wave lengths of colour. Green, for example, was obtained by subtraction and not by addition, and it was necessary clearly to understand when colours were obtained by addition and when they were obtained by subtraction.

Coming to the second portion of the paper, Mr. Bawtree said that it is possible to get any colours by addition. Referring to

the decorative effects obtained in Georgian times, he said it was practically impossible to get the delicate tones for which this period was noted by a single paint. These results were only obtainable by putting two colours on the top of each other, and as an example he demonstrated that a magenta could be obtained by stippling blue on scarlet. It was very important to remember that in nature there were no subtractive colours; everything was additive, and from the colour-matching point of view, the outstanding feature of additive colouring was that the colours remained the same whether examined by the aid of daylight or artificial light. A deep green obtained by additive means gave the same shade in artificial light as in daylight. The reason was that the colour was reflected from the surface in the case of subtractive colours, whereas in the case of additive colours, the colour came from behind. With green, colour was lost at three stages in subtractive colouring, whereas with additive colouring green was lost only at one stage, and that accounted for the reason why additive colours gave almost as perfect a match by artificial light as by daylight. The old decorators of the Georgian times probably did not know this, but they got the effect. As a matter of fact, the best of present-day decorators worked on additive lines, but it was a system which demanded that a great deal more attention should be given to it. This part of the paper was illustrated by a large number of examples of colouring by additive means, and it was suggested in this connection that the use of silver paint, used as a stipple, could be made to give pleasing effects.

### Instruments for Analysis.

Finally, the author dealt with instruments for measuring and analysing colours, of which there are several on the market. One such which he had devised had been accepted by the Post Office inasmuch as the various readings obtained with it had been allowed as forming code words. He had, however, now scrapped the instrument, notwithstanding that he had the plant ready for its manufacture, because he had come to the conclusion that it was fundamentally wrong. The reason why it was fundamentally wrong was that it was impossible to depend upon any instrument which worked upon the basis of dilution of colour for its readings. In some instruments depending upon colour dilution, the effect was obtained by the use of a wedge of glass, which was ground to a fine point, and in this way a thin film of colour was secured, but the accuracy of colour measurement depended upon the amount of material of this nature which was being looked through.

As illustrating this, the lecturer showed the great difference in the colour of a thin film of orange-coloured water and a larger quantity. Having observed this fundamental error in his own original instrument and in other instruments, he had designed another with a larger scope. The existing instruments at best were only suitable for matching colours, and they were no use for analysing colours and finding out how they were made up. His new instrument had this two-fold object: it enabled an analysis to be made of raw materials. It would, no doubt, be argued by some firms that they had good workmen who knew by instinct what would happen when certain materials were used. He agreed that there were such men, and that the results were often extremely creditable to their judgment, but after all it was mainly guesswork, whereas this instrument gave definite knowledge of the composition of materials, and he contended that the firms who wished to be at the head must be those who could say they *knew*, and not those who could only say they *thought* that certain results would follow by the use of certain materials.

The chairman, in proposing a hearty vote of thanks to the author, said that although the author's new instrument was an improvement on the revolving Maxwell disc, in that it dealt with colour mixing, nevertheless a considerable amount of valuable information could be obtained with the disc in the direction of colour harmony. With regard to the advantages of additive and subtractive colour, he took it that the actual colour of the ground when using additive colours would, in a way, be a subtractive colour, and he was wondering what happened to the ground colour, in difference, when compared in daylight and artificial light.

Mr. Bawtree said it was quite true that there might be such an effect as that indicated, but by a little judgment in the composition of the colours used, the error due to the plain subtractive colour could be avoided.

In reply to another speaker, who asked for some information as to how the author's new instrument worked, Mr. Bawtree said there were two parallel tubes lined with mirrors and separated by a narrow tin partition. There was a shutter with slides containing the three primary colours, one above the other—scarlet, green and blue—which were mixed up in the mirrors and reflected on to a piece of ground glass, which gave the diffusion. At the end of the tubes were two sloping pieces of white opal glass, the white light upon which was adjusted so that it was quite even, before the test was made. The shutter, containing the three primary colours on the one side and the colour to be tested on the other, was then inserted, and the result was read off on a graduated scale, in proportions of the various colours.

## British Science Guild

### Sir J. J. Thomson on Departmental Methods

The thirteenth annual meeting of the British Science Guild was held at the Goldsmiths' Hall, London, on Tuesday, Lord Sydenham, president of the Guild, in the chair.

Sir Richard Gregory in proposing the adoption of the annual report and the election of Major-General Seely, Admiral Sir David Beatty, Field-Marshal Sir Douglas Haig, and The Lord Mayor of London (Sir Horace Brooks Marshall) as vice-presidents, referred to the scientific products exhibition which is being organised by the Guild, and which will be held in the Central Hall, Westminster, next month, and said that the building could have been filled several times over if they had been able to accept all the exhibits offered.

The motion was approved.

Major-General Seely in thanking the meeting for his election, said he could tell a long story about what science had done in the war. The head of the Inventions Department of the Ministry of Munitions recently told him that he had come to the conclusion that in time of war in Britain they could invent anything if they were prepared to spend enough money. He asked the Guild to educate public attention to the fact that, if they could command the same zeal and energy in peace as they had in war, illimitable things could be done. They led the world in invention during the war.

Lord Sydenham then delivered an address on "Science and Labour unrest."

Sir Joseph J. Thomson, spoke of the need for the greater use of research. He thought it would be a misfortune if the Admiralty and the War Office had not preserved, to them, the services of the competent men of science, who had been working for them during the war. A real gain had been secured, also, in that a spirit of research had been made much more active in manufactures. People engaged in various industries had, in a large number of cases, combined in forming with the aid of the State, research institutes to solve for themselves important scientific questions that arose from day to day. That seemed to him a movement that was full of promise. He did not know if people generally had noticed that, if they took a piece of woollen cloth and squeezed it up and then released it the creases came out,. But it was different with a piece of cotton. The cause was not known. In that they had a great problem of extraordinary interest, and he believed that the solution of that problem was a matter of enormous financial importance—there were millions in it. It would revolutionise the trade if they got an uncreasable cotton. There were some points on which progress was very necessary. One of the most important of these was the increase in the number of men of real scientific training on the permanent staffs of the Army and Navy, and the great Government departments. He had a letter from one who had been most prominent in the application of science to military purposes. The letter stated that there was no doubt that a complete ignorance of science prevailed at the War Office, and had been a great obstacle to the work of the men of science called in. There was the same dearth of scientific officials in Government departments. Two of his pupils had been selected to interview the head of a department in regard to an appointment. They were told that what they wanted in that office was not a knowledge of science, but a man who could answer letters in such a way as to satisfy the recipient, and not commit the office to anything.

# From Week to Week

It is, perhaps, an interesting sign of the times that the first annual subscriber to THE CHEMICAL AGE was a lady.

Damage estimated at about £20,000 was done by fire last week at the Bush Chemical Works, High Street, Stratford.

Sir W. S. Glyn-Jones, M.P., Secretary of the Pharmaceutical Society, has been in Scotland, speaking on the need for the reconstruction of the organization in Scotland.

It has been decided to form a branch of the Amalgamated Society of Pharmacists and Drug and Chemical Workers in Dundee on trade union lines.

Dr. E. F. Armstrong, Vice-President of the Society of Chemical Industry and Director of Joseph Crosfield & Son, Ltd., Warrington, has been elected to the Vice-chairmanship of the Chemical Engineering Group of the Society of Chemical Industry.

Sir Frederick Black, Director of Navy Contracts, has, with the permission of the Board of the Admiralty, resigned his office, in order to take up an appointment as a managing director of the Anglo-Persian Oil Company.

As the result of a fire which broke out on Monday at the north end of the Dock Estate on the Mersey, two large sheds and their contents, including a large quantity of turpentine and cotton, were destroyed.

According to the latest official figures, a total of £112,000,000 has been realized from the sales of surplus Government property. The main items include £13,991,723 for chemicals and explosives, £8,192,705 for non-ferrous metals, and £2,183,609 for ferrous metals.

A new Portland cement factory is being built at Singapore, at a cost of about £100,000. The factory is to be housed in a large steel building purchased from the Karimon Rubber Company, on Karimon Island, adjacent to Singapore, which is being dismantled.

Four more fellowships for post-graduate study, to be held in the laboratories indicated, have been awarded by the Salters' Institute of Industrial Chemistry to Captain W. H. Hoffert (Oxford), Captain A. G. Pollard (Rothamsted Experimental Station), Mr. L. A. Ravald (Municipal College of Technology, Manchester), and Mr. M. L. Wilson (The University, Manchester).

According to *Stubbs' Weekly Gazette*, the failures in the United Kingdom for the week ended June 14th were twenty, a decrease of two. The number of bills of sale registered and re-registered was eighty-six, an increase of three. Mortgages and charges registered by limited companies amounted to £775,810, the amount authorized (where stated) being £1,010,500.

The two senior partners of P. & P. Campbell, Ltd., Perth, have retired and the control of their dyeworks has been taken over by J. Pullar & Sons, Perth. The business will be carried on at Messrs. Pullar's establishment, under the name of the Perth Dye Works. Recently Messrs. Campbell's works were destroyed by fire. Mr. Peter Campbell, junr., will be associated with the new management.

At a representative meeting of motorists, at York, last week, a resolution was adopted, calling on the Government to give legislative effect to the Fuel Research Board's report on gas standards, provided that the gas companies shall be required to oil-scrub their gases for benzol; and calling on the Government to remove immediately the restrictions at present hampering the manufacture of commercial alcohol for motor purposes.

The Ministry of Munitions has suspended the operation of the following orders under which the control of superphosphate, sulphate of ammonia, ground basic slag, compound fertilizer and sulphuric acid was provided for, viz.: Fertilizer Prices Order, 1918; Compound Fertilizer Order, 1918; Sulphuric Acid Order, 1917; Sulphuric Acid (Amendment of Prices) Order, 1918, and Sulphuric Acid (Amendment of Prices) No. 2 Order, 1918. The Mica Control Order, 1918, has also been suspended.

The British Science Guild has been encouraged to organise an exhibition this year by the success which attended that held at King's College last summer, and the more recent exhibition at the College of Technology, Manchester. The objects of the exhibition are to illustrate recent progress in British Science and Invention, and to help the establishment and development of new British industries. The exhibition, which is fixed for July 3—August 5, will be held in the Central Hall, Westminster.

The Court of Governors of Sheffield University have offered the Vice Chancellorship to Sir Henry Hadow, Principal of the Armstrong College, Newcastle. Sir Henry Hadow, who has intimated his willingness to accept the office, will succeed Dr. Ripper, of the Applied Science Department of the University, who was appointed Vice Chancellor when Mr. H. A. L. Fisher, the Minister of Education, was called from the post. Dr. Ripper had signified his desire to return to his duties as head of the Applied Science Department.

The Committee of Investigation set up by the Joint Industrial Council for the Chemical Trade visited Birmingham last week, and will proceed to Southport on June 27, to enquire into the complaint of process workers that employers in those districts are reducing wages simultaneously with the setting-up of the 48-hour week. The committee, which will meet later in the Yorkshire and North-East Coast areas to conduct similar investigations, is composed of representatives of employers and trade unions, and has power to settle the question, subject to the approval of the Executive of the Joint Council.

The board of the Royal Dutch Petroleum Company propose to offer shareholders an opportunity to subscribe for shares to the value of 42,763,600 florins, giving a right to the whole dividend for 1919. The issue will be divided into shares of 1,000 florins and sub-shares of 100 florins. It is proposed to increase the capital from 230,000,000 to 400,000,000 florins, subject to the decision of a meeting of shareholders. In regard to the new capital of 42,763,600 guilders now to be issued, it is proposed to allow for each four shares or four sub-shares now held, the right to subscribe for one new share or sub-share.

An action by Alexander Cross & Sons, chemical manufacturers, Glasgow, against Charles Tennant & Co., merchants, Belfast, was mentioned in the King's Bench Division, in Dublin, last week. The plaintiffs claimed £797, the price of forty-seven tons of sulphate of ammonia bargained for and sold in May, 1918, to the defendants, or alternatively £150 damages for breach of contract to take delivery of the consignment. The defendants denied that there was any breach of contract, and pleaded that the price charged was in excess of the Government price. An application was made for discovery of documents, and was granted.

The Franklin Medal of the Philadelphia Institute, which has been awarded this year to Sir James Dewar (the first award to a British subject), was handed on May 23rd to Major-General J. O. McLachlan, the representative of the British Army in Washington. Principal Keller, in making the presentation, cited the achievements of Sir James Dewar. Despite his unparalleled record of industry and achievement in pure science, he had distinguished himself equally in applied science; and his two most famous inventions, the "Dewar" flask, known as the "Thermos" bottle, and cordite, invented by him in colloboration with Sir Frederick Abel—had been two most potent factors in the war.

A scheme for enabling employees of the Staveley Coal and Iron Company, Ltd., Chesterfield, to invest in the company on favourable terms has been approved by the shareholders. The preference shares, amounting to £25,000, are to be converted into £1 ordinary shares and offered to members of the staff and workmen at 30s. each, which is 8s. below the market price of the present ordinary shares. All the preference shares have been acquired by the chairman, Mr. Charles Markham, with a view to the carrying out of this arrangement, and he will pay the premium to the company. The company directly employs about 12,000 people; or, including subsidiary companies with which it is connected, 20,000.

Inventors who desire to present a claim to the Royal Commission on Awards to Inventors are invited to submit brief details of their inventions, stating whether they are protected by Letters Patent or not, and giving such reference to any correspondence that may have passed between them and the Department concerned as may enable the cases to be traced. The necessary forms of claim, together with full information as to procedure, will be forwarded to applicants by the Commission when it is clear that a substantial case for hearing by the Commission as a body has been made out; but every application for *ex gratia* remuneration must undergo a preliminary scrutiny by an investigating committee. The address of the Commission is 2, Queen Anne's Gate Buildings, Westminster, S.W. 1.

# Patent Literature.

*Complete information is only obtainable by purchase of the original patent, abstracts being rarely sufficient. Where complete specifications are "open to inspection" but not yet published, fuller information will usually be given in order to obviate a personal visit to the Patent Office. The inclusion of foreign patents is under consideration, and this and other improvements in* THE CHEMICAL AGE *service will be developed in accordance with the suggestions and requirements of our subscribers. Illustrations and diagrams will be used as far as possible to shorten written descriptions.*

### Applications.

Aniline Dyes, packing of. 13,917. J. M. Barnett and H. T. R. Morden.

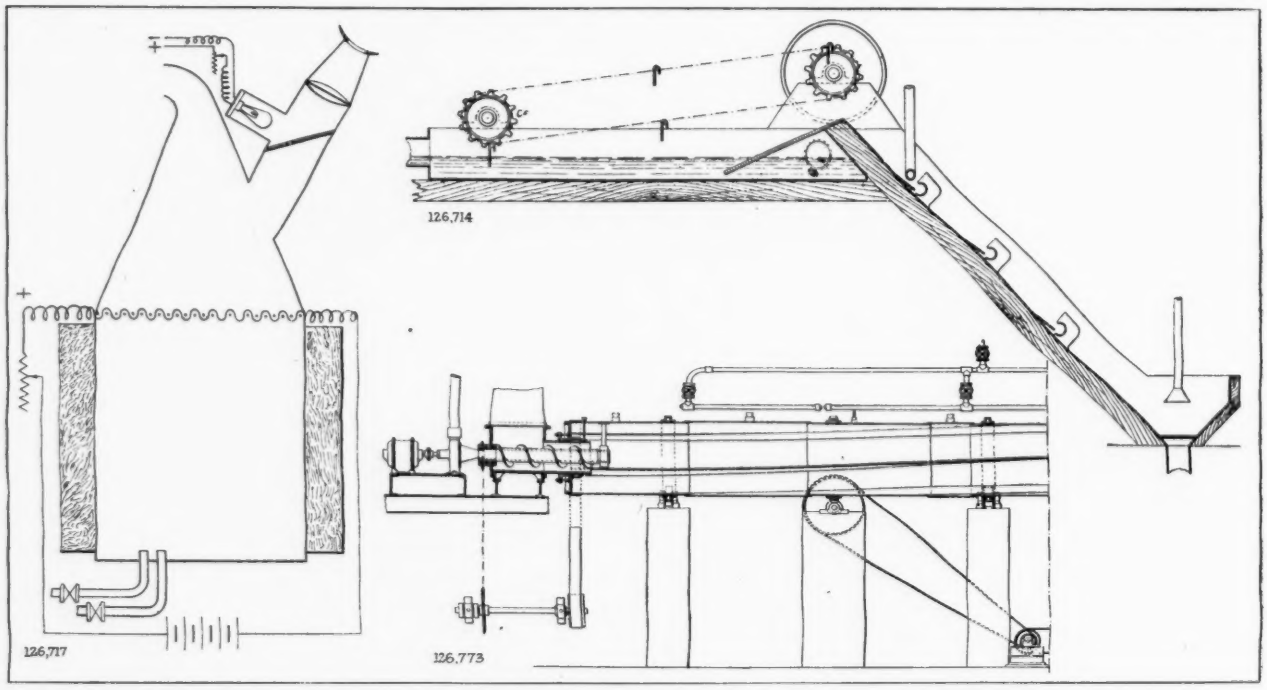
Azo-colouring matters, manufacture of. 14,035. Brotherton & Co., J. A. Lloyd, E. F. Erhardt, and F. H. Smith.

Bottles, stopper for. 13,924. R. G. Armstrong and G. E. Mignon.

Concentration and drying, process for. 14,098. F. Merz.

Evaporating Apparatus. 14,278. M. Rutherford.

Fermented Liquors, production of. 14,158. Amber Size and Chemical Co.




Fertilizer, Utilising waste products for manufacture of. 14,412. F. W. V. Fitzgerald.

Hydrocarbons, production of liquid from carbon. 14,086. F. P. A. Rousseau.

Liquids, treating. 14,097. F. Merz.

Pulverulent Fuel, combustion of. 13,949. Combustion Rationelle Soc. Anon.

Oils, hydrogenation of. 14,340. National Electro-Products, Ltd.

Radium, production of compounds of. 14,439. H. O. Hedstrom.

Rubber, compounds. 13,980. N. D. Nielson.

Rubber, manufacture of. 13,992. W. Feldenheimer, W. W. Plowman, and P. Schidrowitz.

Slag, method of using blast furnace. 14,036. J. G. Squire.

### Abstracts of Complete Specifications.

PICRIC ACID, MANUFACTURE OF. 126,675 and 126,676. D. B. Macdonald, 33, Vulcan Road, Leicester.

The invention has for its object the elimination of danger in the manufacture of picric acid, the improvement being the carrying out of the nitration process in a special manner at a low temperature of approximately 35 deg.C., and the passing of a current of steam through the liquid after nitration.

EXPLOSIVES, IMPROVEMENTS IN. 126,687. D. Chiaraviglio and the firm Bombrini Parodi-Delfino, Rome.

Explosive substances are rendered free from spontaneous ignition by shock in handling or increased temperature arising from friction between the particles. The spaces between the particles are filled by a plastic non-explosive lubricating medium which renders the particles insensitive.

EXPLOSIVES, IMPROVEMENTS IN. 126,698. G. F. Bradley, 38, Belmont Road, Bradley.

According to the invention the improved explosive comprises any nitrated compound produced from the fatty or aromatic series of organic compounds, combined with metals or metallic oxides, and ammonium, potassium or sodium nitrates or alkalies. The following is an example of the proportions:—

| | | |
|---|---|---|
| Ammonium nitrate | .. | 75–80 per cent. |
| Trinitroxylol .. | .. | 15–20 ,, |
| Trinitrotoluol .. | .. | 5– 7½ ,, |
| Aluminium .. .. | .. | 5– 8 ,, |

NITRIC ACID, MANUFACTURE OF CONCENTRATED. 126,704. Dr. E. B. Maxted, 63, Highgate Road, Walsall.

In the manufacture of nitric acid by the interaction of liquid nitrogen peroxide or trioxide with water and excess of oxygen at pressures not appreciably exceeding that of the atmosphere, and at temperatures equal to or slightly above room temperature, the employment of a large excess of the oxide of nitrogen over the stiochiometric proportion required by the water present, such excess being employed for the displacement of equilibrium towards concentrated nitric acid, and being removed after the completion of the reaction, without separation of the liquids into layers.

SULPHURIC ACID, PURIFICATION OF. 126,714. A. E. Wareing and the United Alkali Co., Cunard Building, Liverpool. See illustration.

After the crude acid has been treated with sulphuretted hydrogen it is agitated with a liquid hydrocarbon. The scum is

then removed from the surface and is washed for the recovery of the hydrocarbon, which may then be reused. The acid after treatment with sulphuretted hydrogen and after agitation with the oil is passed through a schute provided with a shelf up which a series of scrapers carry the scum and deliver it to an inclined schute where it is washed.

CATALYSTS, IMPROVEMENTS IN. 126,715. H. E. F. Goold-Adams, J. R. Partington, and Eric K. Rideal, Munitions Inventions Dept., Westminster.

The improvement relates to the method of producing catalysts. The catalyst, instead of being spread upon inert materials such as pumice or fireclay, is precipitated in a finely-divided state, and is then forced through a die to produce rods, threads or filaments, which are then broken into pieces of suitable length.

AMMONIA, OXIDATION OF. 126,716. Patentees as in 126,715. above.

The invention relates to a method of oxidising ammonia whereby a mixture of ammonia and air are passed over a catalyst, consisting of heated chromium oxide prepared by gently igniting a suitable chromium salt having a volatile base.

NITROGEN-OXYGEN COMPOUNDS, IMPROVED METHODS OF PRODUCING. 126,717. Patentees as in 126,715 above. See illustration.

In the production of nitrogen-oxygen compounds by catalysis it has been found that it is a matter of great importance to regulate the temperature of the catalytic material, and in this instance regulation is effected by the provision of a standard sources of light so that direct comparison may be made between the standard source of light and the light radiations from the catalyst.

PERMANGANATES, IMPROVEMENTS IN MANUFACTURE OF. 126,756. H. C. Jenkins and H. Woolner, 810, Salisbury House, E.C.

An improved process for the manufacture of permanganates, which consists in fusing together manganese dioxide with an excess of soda at a dull red heat with the employment of an oxidising agent, dissolving the melt, separating the solution from the manganese mud, electrolysing the liquor to permanganate, precipitating the permanganate and utilising the liquor from which the permanganate has been precipitated in the process.

BLEACHING POWDER, APPARATUS FOR MANUFACTURE OF. 126,773. A. Rudge, The United Alkali Company, Cunard Building, Liverpool. See illustration.

Apparatus for subjecting matter to the action of gases, or vapours; the apparatus comprising a long, horizontal, thin metal cylinder carrying feeding litters which leave a space between themselves and the interior of the cylinder, there being an inlet for the gas, or vapour, at one end of the cylinder, and, at the other end, an inlet for the matter to be treated, means being provided for cooling the cylinder or part thereof, so that the temperature is well under control, excessive action on metal is prevented, and the treated material will leave the apparatus at a temperature suitable for packing.

CATALYSERS, PROCESS FOR REGENERATING NICKEL. 111,840. Société Industrielle de Produits Chimiques, 10, Rue de Vienne, Paris.

A process for regenerating catalysers containing nickel and its compounds which have been employed for the hydrogenation of fatty bodies, which consists in wholly or partially freeing the spent catalyser from adherent organic products, then transforming it into oxide of nickel by heating the constantly-stirred mass with excess of air, washing the catalyser in water, and then heating the resulting mass to about 300 deg. C. for several hours in oil and in a current of hydrogen.

LUBRICATING OILS, TREATING FOR REMOVAL OF SULPHUR. 126,882. J. L. Mantle, Finchfield Lane, Merry Hill, Wolverhampton.

Lubricating oil from an internal combustion engine which has been running on gas, or a petrol substitute, containing sulphur, is rendered unfit for re-use for engine lubrication, by reason of sulphur compounds and other impurities contained therein, and if used for other purposes is objectionable. There is also frequently sulphur contained in lubricating oils, when put upon the market, which tends to render them objectionable. The object of this invention is to treat waste lubricating oils, and lubricating oils in the process of manufacture, if in either case they contain sulphur, for the elimination of sulphur, and in the case of waste lubricating oils for the elimination of other impurities. This is effected by treating the waste oil, or oil in process of manufacture, at a temperature of about 100 deg. C., with barium chloride which reacts with sulphur compounds producing a precipitate which may be filtered off. During the heating of the oil, any petrol, benzol, petrol substitute, or the like, and carbon bi-sulphide and water, contained within or in association with, the oil, are driven off by the heat. By the above treatment waste lubricating oil which has become emulsified has the emulsion completely broken down and, as a consequence, the viscosity of the oil is restored; and the elimination of the sulphur from the waste oil, or from the oil in the process of manufacture, does away with the objectionable characteristics.

β-ALUMNIA, PREPARATION OF. 113,960. The Norton Company of Worcester, U.S.A., L. E. Saunders and R. H. Whiet.

A process for preparing crystalline alumnia in the best modification, consisting in fusing alumnia, sufficiently free from disturbing impurities—namely, certain oxides having an acid character such as $SiO_2$ and $TiO_2$, but containing a proportion of a suitable alkali adequate for the degree of transformation desired—and cooling the fused mass, whereby crystalline alumnia in the beta modification is formed. Also processes for preparing crystalline products in which the proportion of β-alumnia is varied.

GLYCERINE, IMPROVEMENTS IN THE PRODUCTION OF. 126,706. G. J. Lemmens, Lindens, Wateringbury, Kent; and P. J. Fryer, 12, Penbury Road, Tonbridge.

The improvement refers to the production of glycerine by the process which involves the splitting of oil or fat in an autoclave by the conjoint action of heat and pressure. The oil or fat is subjected to the action of heat and a pressure of about 100 lb. per square inch, in the presence of an emulsifying and accelerating agent consisting of oxide and hydroxide of zinc for a period that is less than the normal time for which the oil or fat is ordinarily treated, then withdrawing the strong solution of glycerine formed and replacing it with clean, hot, preferably distilled water to an amount that may suitably be about one-third to one-fourth of the weight of the original charge of oil or fat, and containing the treatment for the remainder of the usual period. Also, utilising the glycerine liquor drawn off from the autoclave at the conclusion of the process in lieu of water for the initial treatment of the next charge of oil or fat.

## The New Victory Loan

SIR ROBERT KINDERSLEY, who met a large gathering of trade and technical journalists at the Savoy Hotel on Tuesday, declared his belief that if we could trace the origin of the great majority of the causes of unrest in this country to-day we should find that they lay in the methods of finance which perforce had had to be adopted during the war. The first step to be taken before we could tackle some of the great national problems now before the country was to stabilise finance; until we had dealt with the financial situation it was idle to try to deal with high prices and the increasing cost of living. The new Victory Loan was calculated to help substantially in this direction by removing the floating debt from the banks into the hands of the real investors and thus releasing the resources of the banks for the purposes for which they should be available—commerce and industry. The general trade and commerce of the country stood to benefit enormously if the new Loan was as successful as they wished it to be, and he made a strong plea for the support of business men.

## Re-Exports to Enemy Countries

The Board of Trade are in receipt of information from the Foreign Office that the Danish Government have now given a general guarantee, which has been accepted by the Associated Governments, that goods imported into that country will not be re-exported to enemy countries. They announce, therefore, that, except for goods on Lists A or B, all restrictions on export to Denmark, whether by frieght or by parcel post have been removed. Exporters should, however, satisfy themselves that the goods are not subject fo any Danish import prohibition. Applications for licences to export goods on Lists A or B should continue to be made to the Export Licence Department, 4, Central Buildings, Westminster, S.W.1.), but no certificates from the Danish Associations need be produced.

# Market Report and Current Prices

*Our Market Report and Current Prices are exclusive to* THE CHEMICAL AGE, *and, being specially prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Charles Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works. Only commodities whose values are at the time of particular interest or of a fluctuating nature are included in our weekly report. A more complete list and report will appear in the first issue of each month, commencing on July 5. The latter will also include prices of plant supplies, building materials, structural steel, fuels, glues, ores, refractories, metals, minerals, and miscellaneous materials, as soon as the necessary arrangements are completed. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report. Suggestions and criticisms in regard to these pages will be welcomed.*

## Market Report.

THURSDAY, June 19, 1919.

The market generally up to the time of going to press has been on the whole quiet. Many works were closed throughout last week, and it is probable, therefore, that business will have considerably revived by the end of this week. Price changes are few, and in many directions it would seem that we are at last approaching a more stable level of values, and should this prove to be correct, it will without doubt stimulate the demand, especially on export account.

Many inquiries for export are now being received and considerable business transacted. The depression which has been noticed for some time past in certain centres, such as the Indian and South American markets, seems to be passing off, and buyers are again showing a disposition to purchase.

### General Chemicals.

ACETONE.—Stocks here are expected to suffice for all industria requirements during 1919 and 1920. Imports are therefore likely to be limited. The price remains at a moderately low figure.

ACID ACETIC.—Although acetate of lime remains unchanged, quotations for acetic are ruling slightly lower in consequence of the freight from America having been reduced. The Government is still carrying heavy stocks of impure synthetic acid. The American makers hold firmly to their latest prices.

ACID OXALIC.—There has been little or no fluctuation during the past month. The consumption is not expected to increase appreciably until the textile industry becomes busier.

ALUMINA SULPHATE.—Manufacturers appear to be fairly well sold. Consumption is on the increase, and there is rather more demand from abroad.

AMMONIA SALTS.—Prices of all ammonia salts are steady. There is an increased enquiry on export account.

ARSENIC.—The price has receded to a level which is likely to stimulate consumption again, and it appears doubtful whether any appreciable reduction in the present value can take place.

BLEACHING POWDER.—The market still remains in a most unsettled condition in consequence of some of the makers being overstocked. The principal industries are not yet absorbing their usual share of the production, and the export business is very much disturbed by keen competition from the U.S.A. We expect to see bleaching powder cheaper for export during the summer months.

BORAX.—There has been a heavy trade passing in this material, and some large enquiries are in the market. It would seem that makers are now in a very sold-up condition.

COPPER SULPHATE.—The price for this article spot and forward for export is £48 per ton less 5% and for Home Trade £15 per ton net. There is practically no business passing however for export. Competition from foreign countries is probable in the nea future.

EPSOM SALTS.—Has been very quiet both for home and export trade.

GREEN COPPERAS.—There is an increased quantity available, but no apparent improvement in the demand.

LEAD ACETATE.—Adequate supplies are now available, and business is proceeding along more normal lines.

LITHOPONE.—The demand for this pigment is rapidly increasing, and stocks are quickly appropriated. Makers are well sold ahead, and shipments from abroad find a ready sale at fair prices.

POTASH BICHROMATE.—There appears to be over-production in America, which is being offered at low prices for export. Many consumers are in arrears with their contracts, and second-hand parcels are freely offered below manufacturers' present quotations.

POTASH CARBONATE.—Large shipments of Russian 90 per cent. are ready for shipment at Archangel, and opportunity is afforded consumers of securing supplies (under licence) at attractive prices.

POTASSIUM NITRATE.—Has been in steady demand.

POTASH PERMANGANATE.—The stocks of Japanese make have been cleared, and it is doubtful whether further consignments will be shipped.

POTASH PRUSSIATE.—There has been a slight improvement in value during this month, and a number of sales have been made.

SODA ACETATE.—There is a revival in the demand for export, although the home trade is still very quiet.

SODA CAUSTIC.—In spite of the keen competition from the U.S.A., considerable quantities of British caustic have been shipped to the East, and the market is showing a slightly better tendency. Although the American manufacturers have been endeavouring to form an association to maintain prices for export, sales are being freely made by dealers below makers' quotations.

SODIUM HYPOSULPHITE.—Trade for commercial crystals has been slow, but business for photographic quality has been very brisk.

SODIUM SULPHIDE.—The manufacturers' quotations remain unchanged, but sales are being made for export by dealers below the makers' quotations.

SULPHUR CHLORIDE.—Large quantities of this product are now available at a low price.

ZINC SALTS.—There are no changes in values to report, and trade has only been of very moderate dimensions.

### Heavy Coal Tar Products.

Business in tar products is gradually becoming more normal, but there are still many difficulties which tend to make the markets irregular in regard both to supplies and to prices.

Manufacturers have to contend with labour difficulties, and exporters have to contend with difficulties regarding licences either for export or for import into foreign countries.

Markets are also much affected by the stocks of various products held by the Allied Governments, but these stocks are, in most cases, gradually becoming exhausted.

BENZOL.—This is an article of considerable interest at the present moment, as, since the Armistice, it has found an increasing use for motor purposes by private consumers, and we may look forward to the time when the whole of the home production of benzol will be consumed in this country. The values at present vary from 1s. 9d. to 1s. 11d. per gallon for export, and 2s. to 2s. 6d. per gallon for home consumption.

SOLVENT NAPHTHA.—This material is much neglected, and is quoted from 1s. 9d. to 2s. per gallon in the North, and 2s. 1d. to 2s. 3d. per gallon in London.

NAPHTHALENE.—This is in slow demand, except for the inferior qualities. To-day's prices are from £4 to £11 per ton for the crude, according to quality, and £16 to £18 per ton for refined.

PITCH.—The demand for export has reduced stocks at some points to a low level, and the difficulties of labour and transit have interfered with the removal of stocks in the interior, so that prices are well maintained. To-day's quotations are 67s. 6d. f.o.b., London; 52s. 6d. to 55s. f.o.b., East Coast; 46s. 6d. to 48s. 6d. f.o.b., West Coast.

CARBOLIC ACID.—This material is entirely unsaleable owing to the large Government stocks in this country and in France.

CRESYLIC ACID.—This article is in moderate request at 2s. 6d. and 2s. 7d. per gallon for the 95 per cent., and 2s. 9d. to 3s. per gallon for the 97 per cent.

### Sulphate of Ammonia.

This material is still controlled through arrangements made by the Board of Agriculture, and the prices for sulphate for home consumption are much below the figures for export, the former being £17 to £19 per ton, while the latter range from £ 1 10s. to £31 f.o.b.

### Coal Tar Intermediates.

Many English dye and colour manufacturers are dependent upon America for their supplies of certain intermediates, as the production in this country only appears to be sufficient at present for the requirements of the principal works.

ANTHRANILIC ACID.—Supplies are difficult to obtain from English makers, but American manufacturers are now coming forward with offers for export.

ANTHRACENE.—There is an increasing demand for the higher strength—80 and 95 per cent.

BETANAPHTHOL.—A quality fully equal to the best American make is now obtainable from British makers, and the demand for it is improving.

BENZALDEHYDE is now being manufactured in increasing quantities in this country, and there is no longer any necessity to go abroad for this product.

BENZYL CHLORIDE.—The consumption of this product has increased considerably, and there is a fairly good demand for export.

METANITROPARATOLUIDINE.—Business still remains inactive in this important intermediate, and increasing supplies are shortly expected from American sources.

ORTHOAMIDOPHENOL.—This intermediate is specially required for certain colours, and we expect to see developments in the manufacture of it.

PARAMIDOPHENOL.—The demand for photographic and other purposes continues to increase, and the English product is superior to that which was formerly imported from America.

TECHNICAL RESORCIN.—The high prices which have been ruling for the imported product are likely to be seriously affected by new makes which are now appearing on this market.

## Current Prices.

### Chemicals.

*June 19th, 1919.*

| | per | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Acetic anhydride | lb. | 0 | 3 | 6 | to | 0 | 3 | 9 |
| Acetone, pure | ton | 95 | 0 | 0 | to | 97 | 0 | 0 |
| Acid, Acetic, glacial, 99-100% | ton | 77 | 10 | 0 | to | 80 | 0 | 0 |
| Acetic, 80% pure | ton | 62 | 10 | 0 | to | 65 | 0 | 0 |
| Citric | lb. | 0 | 4 | 4 | to | 0 | 4 | 5 |
| Lactic, 50% vol. | ton | 70 | 0 | 0 | to | 72 | 10 | 0 |
| Lactic, 60% vol. | ton | 85 | 0 | 0 | to | 87 | 10 | 0 |
| Oxalic | lb. | 0 | 1 | 2½ | to | 0 | 1 | 3 |
| Pyrogallic cryst. | lb. | 0 | 10 | 6 | to | 0 | 11 | 0 |
| Tannic, coml. | lb. | 0 | 2 | 9 | to | 0 | 3 | 0 |
| Tartaric | lb. | 0 | 3 | 3 | to | 0 | 3 | 4 |
| Alum, lump | ton | 17 | 15 | 0 | to | 18 | 0 | 0 |
| Aluminium sulphate, 14-15% | ton | 13 | 10 | 0 | to | 14 | 0 | 0 |
| Aluminium sulphate, 17-18% | ton | 17 | 10 | 0 | to | 18 | 0 | 0 |
| Ammonia, anhydrous | lb. | 0 | 1 | 9 | to | 0 | 2 | 0 |
| .880 | ton | 32 | 10 | 0 | to | 37 | 10 | 0 |
| Carbonate | lb. | 0 | 0 | 6½ | | | | |
| Muriate | ton | 48 | 0 | 0 | to | 50 | 0 | 0 |
| Nitrate | ton | 55 | 0 | 0 | to | 60 | 0 | 0 |
| Phosphate | ton | 110 | 0 | 0 | | | | |
| Arsenic, white 99-100% | ton | 36 | 0 | 0 | to | 37 | 0 | 0 |
| Barium, Carbonate, 92-94% | ton | 11 | 10 | 0 | to | 12 | 0 | 0 |
| Chloride | ton | 27 | 0 | 0 | to | 27 | 10 | 0 |
| Nitrate | ton | 51 | 0 | 0 | to | 52 | 0 | 0 |
| Suplhate, pulp blanc | ton | 15 | 10 | 0 | to | 16 | 0 | 0 |
| Sulphate, dry fixed | ton | 25 | 10 | 0 | to | 26 | 0 | 0 |
| Bleaching powder, 35-37% | ton | 14 | 0 | 0 | to | 14 | 10 | 0 |
| Borax crystals | ton | 39 | 0 | 0 | to | 39 | 10 | 0 |
| Calcium acetate, grey | ton | 16 | 0 | 0 | to | 16 | 10 | 0 |
| Calcium chloride | ton | 8 | 10 | 0 | to | 9 | 0 | 0 |
| Cobalt oxide, black | lb. | 0 | 7 | 9 | to | 0 | 8 | 0 |
| Copper sulphate | ton | 45 | 0 | 0 | to | 47 | 0 | 0 |
| Cream Tartar, 98-100% | ton | 235 | 0 | 0 | to | 240 | 0 | 0 |
| Epsom salts (see Magnesium Sulphate). | | | | | | | | |
| Iron, perchloride | ton | 30 | 0 | 0 | to | 32 | 0 | 0 |
| Sulphate (copperas) | ton | 5 | 10 | 0 | to | 6 | 10 | 0 |
| Lead, Acetate, white | ton | 82 | 10 | 0 | to | 85 | 0 | 0 |
| Nitrate | ton | 58 | 10 | 0 | to | 59 | 0 | 0 |
| Lithopone, 30% | ton | 42 | 10 | 0 | to | 45 | 0 | 0 |
| Magnesium, chloride | ton | 15 | 0 | 0 | to | 16 | 0 | 0 |
| Carbonate, light | cwt. | 3 | 0 | 0 | to | 3 | 5 | 0 |
| Sulphate (Epsom salts, coml.) | ton | 11 | 0 | 0 | to | 11 | 10 | 0 |
| Sulphate (druggist's) | ton | 16 | 10 | 0 | to | 18 | 0 | 0 |
| Methyl Acetone | ton | 89 | 0 | 0 | to | 99 | 0 | 0 |
| Methyl Alcohol | gall. | 0 | 9 | 0 | to | 0 | 9 | 6 |
| Potassium, Bichromate | lb. | 0 | 1 | 6 | to | 0 | 1 | 7 |
| Carbonate, 80-85% | ton | 80 | 0 | 0 | to | 85 | 0 | 0 |
| Chlorate | lb. | 0 | 1 | 3 | to | 0 | 1 | 4 |
| Metabisulphite (pdr. or cryst., 50-52%) | ton | 200 | 0 | 0 | to | 205 | 0 | 0 |
| Nitrate refined | ton | 58 | 0 | 0 | to | 60 | 0 | 0 |
| Permanganate | lb. | 0 | 3 | 6 | to | 0 | 3 | 9 |
| Prussiate, yellow | lb. | 0 | 1 | 9 | to | 0 | 1 | 10 |
| Prussiate, red | lb. | 0 | 6 | 6 | to | 0 | 6 | 3 |
| Sulphate | ton | 37 | 10 | 0 | to | 40 | 0 | 0 |
| Sal. Ammoniac, firsts | cwt. | 4 | 0 | 0 | | | | |
| Sal. Ammoniac, seconds | cwt. | 3 | 15 | 0 | | | | |
| Sodium, acetate | ton | 62 | 10 | 0 | to | 65 | 0 | 0 |
| Arseniate, 45% | ton | 47 | 0 | 0 | to | 47 | 10 | 0 |
| Bicarbonate | ton | 9 | 0 | 0 | to | 9 | 10 | 0 |
| Bisulphite, 60-62% | | — | | | | — | | |
| Chlorate | lb. | 0 | 0 | 8 | to | 0 | 0 | 8½ |
| Caustic, 70% | ton | 19 | 0 | 0 | to | 19 | 10 | 0 |
| Caustic, 76% | ton | 23 | 0 | 0 | to | 23 | 10 | 0 |
| Hyposulphite, coml. | ton | 17 | 0 | 0 | to | 17 | 10 | 0 |
| Nitrite, 96-98% | ton | 60 | 0 | 0 | to | 62 | 10 | 0 |
| Phosphate cryst. | ton | 25 | 0 | 0 | to | 25 | 10 | 0 |
| Prussiate | lb. | 0 | 0 | 8 | to | 0 | 0 | 8½ |
| Sulphide, cryst. | ton | 16 | 0 | 0 | to | 16 | 10 | 0 |
| Sulphide, solid, 60-62% | ton | 21 | 10 | 0 | to | 24 | 0 | 0 |
| Sulphite, cryst. | ton | 11 | 0 | 0 | to | 11 | 10 | 0 |
| Strontium, Carbonate | ton | 55 | 0 | 0 | | | | |
| Sulphate, white | ton | 11 | 10 | 0 | to | 12 | 10 | 0 |
| Sulphur, chloride | ton | 38 | 0 | 0 | to | 40 | 0 | 0 |
| Tin perchloride, 33% | lb. | 0 | 2 | 4 | to | 0 | 2 | 5 |
| Protochloride (tin crystals) | lb. | 0 | 1 | 8 | to | 0 | 1 | 9 |
| Zinc, chloride, 102 Tw. | ton | 23 | 0 | 0 | to | 25 | 0 | 0 |
| Chloride, solid, 96-98% | ton | 62 | 0 | 0 | to | 62 | 10 | 0 |
| Sulphate | ton | 21 | 10 | 0 | to | 23 | 0 | 0 |

### Coal Tar Intermediates, &c.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alphanaphthol, crude | lb. | 0 | 3 | 0 | to | 0 | 3 | 6 |
| Alphanaphthol, refined | lb. | 0 | 3 | 6 | to | 0 | 3 | 9 |
| Alphanaphthylamine | lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |
| Aniline oil, drums free | lb. | 0 | 1 | 2 | to | 0 | 1 | 3 |
| Aniline salts | lb. | 0 | 1 | 3½ | to | 0 | 1 | 4 |
| Anthracene, 80% | lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |
| Benzaldehyde (free of chlorine, | lb. | 0 | 9 | 0 | to | 0 | 9 | 6 |
| Benzidine, base | lb. | 0 | 5 | 6 | to | 0 | 6 | 0 |
| Benzidine, sulphate | lb. | 0 | 4 | 9 | to | 0 | 5 | 0 |
| Benzoic, acid | lb. | | — | | | | — | |
| Benzyl chloride, technical | lb. | | — | | | | — | |
| Benzoate of soda | lb. | | — | | | | — | |
| Benzyl chloride, technical | lb. | 0 | 1 | 9 | to | 0 | 2 | 0 |
| Betanaphthol Benzoate | lb. | | — | | | | — | |
| Betanaphthol | lb. | 0 | 2 | 3 | to | 0 | 2 | 6 |
| Betanaphthylamine sublimed | lb. | 0 | 8 | 0 | to | 0 | 8 | 6 |
| Dichlorbenzol | lb. | 0 | 0 | 5 | to | 0 | 0 | 6 |
| Deithylaniline | lb. | 0 | 7 | 0 | to | 0 | 8 | 0 |
| Dinitrobenzol | lb. | 0 | 1 | 4 | to | 0 | 1 | 6 |
| Dinitrochlorbenzol | lb. | 0 | 1 | 2 | to | 0 | 1 | 3 |
| Dinitronaphthaline | lb. | 0 | 2 | 0 | to | 0 | 2 | 3 |
| Dinitrotoluol | lb. | 0 | 1 | 10 | to | 0 | 2 | 0 |
| Dinitrophenol | lb. | 0 | 1 | 10 | to | 0 | 2 | 0 |
| Dimethylaniline | lb. | 0 | 2 | 9 | to | 0 | 3 | 0 |
| Diphenylamine | lb. | 0 | 3 | 0 | to | 0 | 3 | 3 |
| H-Acid | lb. | 0 | 7 | 6 | to | 0 | 8 | 0 |
| Metaphenylenediamine | lb. | 0 | 4 | 6 | to | 0 | 4 | 9 |
| Monochlorbenzol | lb. | 0 | 0 | 9 | to | 0 | 0 | 10 |
| Naphthionic acid, crude | lb. | 0 | 3 | 6 | to | 0 | 3 | 9 |
| Naphthylamin-di-sulphonic acid | lb. | 0 | 4 | 6 | to | 0 | 5 | 0 |
| Nitronaphthaline | lb. | 0 | 1 | 2 | to | 0 | 1 | 6 |
| Nitrotoluol | lb. | 0 | 1 | 3 | to | 0 | 1 | 6 |
| Orthoamidophenol | lb. | 0 | 18 | 0 | to | 1 | 0 | 0 |
| Orthodichlorbenzol | lb. | 0 | 1 | 1 | to | 0 | 1 | 3 |
| Orthotoluidine | lb. | 0 | 2 | 0 | to | 0 | 2 | 3 |
| Orthonitrotoluol | lb. | 0 | 1 | 6 | to | 0 | 1 | 9 |
| Para-amidophenol, base | lb. | 0 | 14 | 0 | to | 0 | 15 | 0 |
| Para-amidophenol, hcl. | lb. | 0 | 15 | 6 | to | 0 | 16 | 0 |
| Paradichlorbenzol | lb. | 0 | 0 | 4 | to | 0 | 0 | 5 |
| Paranitraniline | lb. | 0 | 4 | 0 | to | 0 | 4 | 6 |
| Paranitrotoluol | lb. | 0 | 5 | 3 | to | 0 | 5 | 6 |
| Paraphenylenediamine, distilled | lb. | 0 | 15 | 0 | to | 0 | 16 | 0 |
| Paratoluidine | lb. | 0 | 7 | 0 | to | 0 | 7 | 6 |
| Phthalic, anhydride | lb. | 0 | 14 | 0 | to | 0 | 15 | 0 |
| Resorcin, technical | lb. | 0 | 15 | 0 | to | 0 | 16 | 0 |
| Resorcin, pure | lb. | | — | | | | — | |
| Salicylic acid | lb. | | — | | | | — | |
| Salol | lb. | | — | | | | — | |
| Sulphanilic acid, crude | lb. | 0 | 1 | 0 | to | 0 | 1 | 3 |
| Toluidine, base | lb. | 0 | 9 | 0 | to | 0 | 10 | 0 |
| Toluidine, mixture | lb. | 0 | 2 | 9 | to | 0 | 3 | 0 |

# Company Notes

NEW TRANSVAAL CHEMICAL CO.—At the ordinary general meeting, in London, resolutions were passed authorising the payment of dividends, making a total distribution for the year of 6 per cent. on the first preference and 8 per cent. on the "A" preference shares, and of a dividend at the rate of 20 per cent per annum on the ordinary shares. Mr. Cecil A. Campbell was re-elected a director. The chairman announced that the company had had another very prosperous year.

ROYAL DUTCH PETROLEUM COMPANY.—The Royal Dutch Petroleum Company propose a final dividend of 25 per cent., making 40 per cent. for the past year. The directors recommend that the capital be increased from 230,000,000 to 400,000,000 guilders, and that 42,763,600 guilders be issued in shares of 1,000 guilders and under-shares of 100 guilders, holders of every four shares of the respective classes being allowed to subscribe for one similar new share at par. The distribution was 33 per cent. for 1917, 38 per cent. for 1916, and 49 per cent. for 1915.

BRITISH MAIKOP OIL CO.—The directors of the British Maikop Oil Company have received advices from the company's manager in Russia, to the effect that the properties and the plant and machinery in the Maikop field are intact, and have not suffered to any material extent. The total production during the period from the date of the last accounts—viz., July 13th, 1916, up to the end of December, 1918—was 248,865 poods, or about 4,014 tons; the price of crude oil had risen to 7 roubles per pood, against 48 kopeks (approximately ½ rouble) per pood in 1916; the cost of labour and all other working expenses is also considerably higher. The net result will show a working profit; and there has been accumulated approximately 164,000 roubles at the end of December, 1918. The manager has recommended the sinking of a well on plot 434 and it is hoped to commence this at an early date. The directors state that negotiations are taking place with a view to procuring the guarantee of the subscription of the whole of the unissued shares, and they will make an offer of shares to the shareholders as soon as the details in connection with the proposed issue are settled and the sanction of the Treasury (if this is necessary), has been obtained.

YOUNG'S PARAFFIN, LIGHT AND MINERAL OIL CO.—At the general meeting, in Glasgow, a dividend of 6 per cent. for the year on the ordinary shares was declared, payable in equal portions on June 20th and December 19th, 1919; with a contingent dividend of 6 per cent. per annum on the "B" debenture bonds, to be wholly paid on August 1st next in terms of the conditions of the bonds—less income tax in both cases. Lord Glenarthur (who presided), stated that the net profit for the year was £91,162, including the balance brought forward from last year. There was no doubt, he said, that the present conditions and the future prospects of the trade gave cause for anxiety. Soon after the armistice there were drastic reductions in the prices of the company's products, owing to the freer importation of the products which competed with those manufactured in Scotland, and these had an immediate effect on the profit-earning capacity of the company. Since the beginning of the financial year, there has been a further fall in prices, and concurrently with that they had been called upon to face a retrospective and future increase in manufacturing costs, owing to having to concede to the shale miners and shale oil workers the award given by Mr. Justice Sankey's Commission to the coal trade. The industry was able to render valuable assistance to the nation during the war, and that at a critical time. It has worked cordially with the Government during the war, and, therefore, it was only right and proper, in view of the steps that may have to be taken, that the representatives of the companies should place the position before the Government. An interview was promptly granted and a deputation was courteously received, and they had the promise that the matter would be carefully considered by the Government.

BRITISH DYESTUFFS CORPORATION.—At a special meeting of the British Dyestuffs Corporation in Manchester, on Tuesday, it was resolved to increase the capital to £10,000,000 by the creation of two million preferred ordinary and two million preference shares of £1 each. Lord Moulton, who presided, said that the necessity of increasing the capital to enable them to do the very serious and important work before them would be plain to all the shareholders. The resolutions did not in any way prejudice the terms of the issue. The shareholders will have full notice before any steps are taken and a prospectus will be published.

# Stocks and Shares

**Commercial, Industrial, &c.**

| | Quotations June 18. |
|---|---|
| Alby United Carbide Factories, Lim., Ord. | 31/32 — 1 3/32 |
| Associated Portland Cement Manufrs. (1900.) Lim., Ord. | 7⅝ — 7⅞ |
| Bell's United Asbestos Co., Lim., Ord. | 2 3/16 — 2 7/16 |
| Bleachers' Association, Lim., Ord. | 1 9/32 — 1 11/32 |
| Borax Consolidated, Lim., Prefd. Ord. | 4⅜ — 4⅞ |
| Bradford Dyers' Assoc. Lim., Ord. | 2 3/16 — 2 5/16 |
| British Aluminium Co., Lim., Ord. | 1⅝ — 1¾ |
| British Oil and Cake Mills, Lim., Ord. | 1⅞ — 2 |
| British Portland Cement Manufrs., Lim., Ord. | 33/ — 35/ |
| Brunner, Mond & Co., Lim., Ord. | 1 15/16 — 2 1/16 |
| Castner-Kellner Alkali Co., Lim. | 2⅞ — 3 ⅛ |
| China Clay Corporation, Lim., Ord. | ¼ — ⅜ |
| Cook (Edward) & Co., Lim., 4% 1st Mort. Deb. Stock Red. | 57 — 61 |
| Courtaulds, Lim. | 9 13/16 — 10 1/16 |
| Crosfield (Joseph) & Sons, Lim., Cum. 6% Prefce. | |
| Curtis's & Harvey, Lim. | ⅞ — 1⅛ |
| Explosives Trades, Lim., Ord. | 22/ — 23/ |
| Field (J. C. & J.), Lim., Ord. | 7/28 — 9/16 |
| Greenwich Inlaid Linoleum (Fredk Walton's New Patents) Co., Lim., Ord. | ½ — ⅝ |
| Harrison & Crosfield, Lim., 10% Cum. Prefd. Ord. | 1 11/32 — 1 15/32 |
| India Rubber, Gutta Percha and Tel. Wks. Co., Lim., Ord. | 17½ — 18 |
| Lawe Chemical Manure Co., Lim., Ord. | 6 — 6½ |
| Lever Bros., Lim., 6 % Cum. "A" Prefce. | 20/6 — 22 |
| Do. 6½ % Cum. "B" Prefce. | 21/6 — 22 |
| Magadi Soda Co., Lim., Ord. | 1 3/32 — 1 7/32 |
| Manganese Bronze and Brass Co., Lim., Ord. | |
| Maypole Dairy Co., Lim., Defd. Ord. | 1⅛ — 1 3/16 |
| Mond Nickel Co., Lim., 7% Cum. Pref. | 1⅛ — 1¼ |
| Do. 7% Non. Cum. Pref. | 1 — 1⅛ |
| Pacific Phosphate Co., Lim., Ord. | 4⅞ — 5⅛ |
| Power-Gas Corporation, Lim., Ord. | ⅜ — ⅞ |
| Price's Patent Candle Co., Lim. | 39½ — 41½ |
| Salt Union, Lim., Ord. | 1¼ — 1⅜ |
| United Alkali Co., Lim., Ord. | 1 5/16 — 1 9/16 |
| Val de Travers Asphalte Paving Co., Lim. | 15/16 — 1 1/16 |
| Van den Berghs, Lim., Ord. | 3 9/16 — 3 13/16 |
| Walkers, Parker & Co., Lim. | 1 1/16 — 1 3/16 |
| Welsbach Light Co., Lim. | 2¾ — 3 |

**Gas, Iron, Coal and Steel.**

| | |
|---|---|
| Gas Light and Coke Co., Ordinary Stock (4% Stand.) | 59 — 61 |
| South Metropolitan Gas Co., Ordinary (4% Stand.) | 60 — 62 |
| Ebbw Vale Steel, Iron & Coal Co., Lim., Ord. | |
| Hadfield's, Limited, Ordinary | 2¼ — 2 3/16 |
| Staveley Coal & Iron Co., Lim., Ord. | 1⅞ — 2 |
| Vickers, Limited, Ordinary | 36/6 — 37/6 |

**Mines, Nitrate, &c.**

| | |
|---|---|
| Rio Tinto Co., Lim., Ord. (Bearer) | 56½ — 58½ |
| Antofagasta Nitrate Co. Compañia de Salitres de Antofagasta) 5½% 1st. Mt. Debs. Red. | 91 — 96 |
| Lagunas Nitrate Co., Lim. | 1⅜ — 1⅝ |
| Tarapaca and Tocopilla Nitrate Co., Lim. | 16/– — 17/– |

**Oil and Rubber.**

| | |
|---|---|
| Anglo-Persian Oil Co., Lim., Cum. 6 % Part. | 1 5/16 — 1 ⅜ |
| Mexican Eagle Oil Co., Lim. (Cia Mexicana de Pet. "El Aguila" S.A.) 8% Pref. (Bearer Non. Cum.) | 7 — 7⅛ |
| "Shell" Transport and Trading Co., Lim., Ord. | 9 5/16 — 9 3/16 |
| Do. 5% Cum. Pref. | 8 15/16 — 9 3/16 |
| Anglo-Java Rubber & Produce Co., Lim. | 6/4½ — 6/10½ |
| Anglo-Malay Rubber Co., Lim. | 12/7½ — 13/1½ |
| Chersonese (F.M.S.) Estates, Lim. | 3/9 — 4/– |
| Linggi Plantations, Lim., Ord. | |

Mr. H. M. Jenks, prospector of Harma's British Photoplays, who has just returned to this country after a visit to the United States, strongly urges that an effort should be made to develop the film industry in this country.

# Commercial Intelligence.

LONDON GAZETTE,

### Notice of Dividend.

MERSEY CHEMICAL WORKS, LTD., Alderman's House, Alderman's Walk, London. 20s., first and final. June 18, or on any subsequent day (except Saturday) between 11 and 2. Office of the Official Receiver and Liquidator, 33, Carey Street, Lincoln's Inn, W.C.2.

### Winding Up Order.

THE COLNBROOK CHEMICAL AND EXPLOSIVES CO., LTD., 8, Victoria Street, Westminster, London. High Court of Justice, June 14.

### Partnership Dissolved.

CRAGG, William, SHEPHERD, Frederick Walter, and CRAGG, Herbert, chemists, 112, 212 and 214, Arkwright Street, and 57, Mansfield Road, Nottingham, under the style of Cragg and Shepherd, as and from March 29, 1919, by mutual consent. All debts received and paid by William Cragg, who will carry on the business.

### Liquidator's Notice.

EGYPTIAN OIL TRUST, LTD. (in liquidation).—A general meeting of members will be held in the Cannon Street Station Hotel, London, on Thursday, July 17, at 3.15 p.m. A. Mackay, liquidator.

### Companies Winding Up Voluntarily.

CHEMICAL PRODUCTS, LTD.—J. J. Marsh, 41, Newcomen Street, London, S.E., appointed liquidator.

THE RIETPOORT PETROLEUM SYNDICATE, LTD.—Mr. Arthur Kitching, of 37, Old Jewry, London, E.C., appointed liquidator. A meeting of creditors will be held at 37, Old Jewry, London, E.C., on Wednesday, June 25, at 12 noon.

### Petition for Winding Up Order.

SYNTHETIC COAL SYNDICATE, LTD.—A petition for the winding up of the company was on June 6, presented to the High Court of Justice by Vickery, Hunt & Co., of Russell Road, Bowes Park, Middlesex, general engineers, creditors, and the petition was directed to be heard before the Court sitting at the Royal Courts of Justice, Strand, London, on Tuesday, June 24, 1919.

### New Companies, Registered.

The following list has been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C.:—

RUBBER SUPPLY CO., LTD., 8, Chapel Bar, Nottingham. Nominal capital £2,000 in 2,000 shares of £1 each. Directors: A. R. Mowforth, 56, Kimbolton Avenue, Nottingham; F. Stevens, Claremont, 9, Grange Road, Daybrook; T. H. Knight, 7, Balmoral Avenue, West Bridgeford; G. Daubrah, 64, Teversal Avenue, Nottingham. Qualification of Directors, 1 share. Remuneration of Directors, Managing Director, £5 per week; others to be voted by company in general meeting.

BURLECTAS, LTD., 11, Pancras Lane, Queen Street, E.C. 4. To institute, carry on, assist or participate in engineering, financial, and other businesses, &c. Nominal capital £5,000 in 3,500 6% preference shares and 2,500 ordinary shares of £1 each. Directors: J. Burgess, Ivanhoe Hotel, Bloomsbury, W.C.; A. G. Leck, Ravenshoe, Burgh Heath, Surrey; E. E. Tasker, Oak Bank, Hutton, Brentwood, Essex. Qualification of Directors, 1 share. Remuneration of Directors to be voted by company in general meeting.

PLASMET, LTD., 45, Brecknock Road, N.W. 1. To acquire the formula as to the process of manufacturing and the right to manufacture and deal in a certain metallic cement named "Plasmet." Nominal capital £5,000 in 3,000 preference shares of £1 each and 4,000 ordinary shares of 10s. Directors to be appointed by subscribers. Qualification of Directors, £250. Remuneration of Directors to be voted by company in general meeting.

THALASSOIDS, LTD., 1, Winchester Street, E.C. To acquire letters patent, &c., and turn same to account and carry on the business of chemists, &c. Nominal capital £2,000 in 4,000 cum. par. preference shares and 4,000 ordinary shares of 5s. each. Directors to be appointed by subscribers. Qualification of Directors, 100 ordinary shares. Remuneration of Directors, £250, to be divided.

ACTON ALUMINIUM AND BRONZE CO., LTD., Bank Buildings, 186, High Street, Acton, Middlesex. Nominal capital £10,000 in 10,000 shares of £1 each. Directors: A. Webster, 2, Layer Gardens, Acton, W. 3., Life Director. Qualification of Directors, £5. Remuneration of Directors, £100 each Life Directors. Others £50 each.

JENNISON, LTD., 4, Waltham Street, Hull. paint, oil, water, paint, colour, grease, and varnish merchants and retailers, &c. Nominal capital £2,000 in 2,000 shares of £1 each. Directors to be appointed by subscribers. Qualification of Directors, 250 shares. Remuneration of Directors to be voted by company in general meeting.

COLONIAL OIL AND PIPELINE CO., LTD. Nominal capital £100 in 100 shares of £1 each. Directors: E. Hopkin, 52, Gaskarth Road, Balham, S.W. (Chairman); F. J. Abbott, 147, North View Road, Hornsey, N. (Managing Director). Qualification of Directors (other than first Directors), £100. Remuneration of Directors, £100 each; Chairman £200.

## Shrinkage in Soap.

Before the Recorder (Sir Forrest Fulton, K.C.), in the Lord Mayor's Court, on Wednesday, H. E. Castle, soap agent, of Leadenhall House, Leadenhall Street, E.C., brought an action against Hay & Co., chemical merchants, of Leadenhall Street, E.C., to recover damages for breach of contract in respect of the delivery of a quantity of soap. Mr. Rowland Thomas was Counsel for plaintiff, while the defendants were represented by Mr. H. Collins.

Mr. Thomas said that the claim arose in connection with a sale by the defendants to the plaintiff of 30 tons of soap. The defendants knew that the plaintiff was purchasing the soap for a third party, a firm of merchants carrying on business in the City. The plaintiff's customer complained that there was a shortage in the quantity delivered, and the defendants said that they would communicate with the firm from whom they bought, Messrs. Bentley & Co., of Manchester. Later they stated that they were informed that each case contained the right quantity of soap, and the plaintiff was told that he could do what he liked in the matter. Messrs. Watson, to whom the plaintiff sold the goods, commenced an action against him in that Court in respect of a shortage of 7 cwt. 3 qrs. 7 lb., the amount of the claim being £28 5s. 6d. The plaintiff disputed the claim, but Messrs. Watson recovered judgment for the amount of their claim, and the plaintiff also had to pay about £66 in respect of costs. The plaintiff now claimed that he should be reimbursed by the defendants for those two sums.

The plaintiff, giving evidence in support of his claim, said that as a result of hearing that the defendants had certain soap for sale, he approached Messrs. Watson & Co., and obtained an order from them for 30 tons at £72 10s. a ton. He placed the order with the defendants, agreeing to pay them £71 a ton. The first consignment of 10 tons was in order, and in respect of the second consignment he had paid the defendants £710. His buyers complained of a shortage in the second delivery, and commenced proceedings in that Court. The judgment was given against him. He gave the present defendants notice of the action. After the action, he wrote to the defendants saying that he looked to them to recoup him for the loss he had sustained. The witness added that he never handled the goods himself, and they were sent to a wharf at Wapping. In cross-examination the plaintiff said he had had some experience of soap, and he knew that it lost weight after some little time, and more especially in the summer months. The loss would, however, be imperceptible for some weeks.

Counsel suggested that when soap was first made it contained a quantity of water, and lost considerably in weight, and the witness replied that when in bulk the shrinkage was not so great. The contract he entered into with the defendants was for the goods to be delivered f.o.r. London. He did not know

that a receipt was given to the railway company for goods of the weight of 11 tons 3 cwt.

Evidence as to the shortage in the weight of the second consignment was given by Mr. J. T. Watson, who said that manufacturers, when packing cases of soap, put in an extra bar to make up for any shrinkage that occurred. He did not think it was possible for 7 cwt. of soap to have disappeared by shrinkage in the time in question.

Mr. Collings submitted that the defendants had no case to answer. The contract was for the goods to be delivered f.o.r. London, and that contract they carried out and completed when the goods arrived at King's Cross. It had not been proved that there was any shrinkage in the weight when the soap arrived at King's Cross, and, therefore, the plaintiff's case could not succeed. The railway company was given a clean receipt for the goods.

The Recorder held that the plaintiff had not proved that there was any shortage in the goods on their arrival in London, and he entered judgment for the defendants, with costs.

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This Week's issue of the *Board o Trade Journal* contains preliminary particulars of the French Presidential Decrees, published yesterday in the *Journal Officiel* (Wednesday, June 18), providing for the abolition of import restrictions on a large number of goods imported into France or Algeria, and the increase, by means of *ad valorem* surtaxes, of the rates of customes' duty upon goods imported into those countries. Copies of the Decrees in question are on view at the Offices of the Department ot Overseas Trade, 73, Basinghall Street, E.C. 2, and the full translation will be pulibshed in next Thursday's issue of the *Board of Trade Journal*.

Speaking at a luncheon at Claridge's Hotel, London, Mr. Alfred C. Bedford, chairman of the board of directors of the Standard Oil Company (New Jersey), stated that during the war the French Armies alone consumed about 35,000 tons ot gasoline a month. During the heavy fighting last year, the Allied Armies in France used 2,000 tons of motor spirit every day. At the signing of the armistice, 48 per cent. of the British warships used oil instead of coal.

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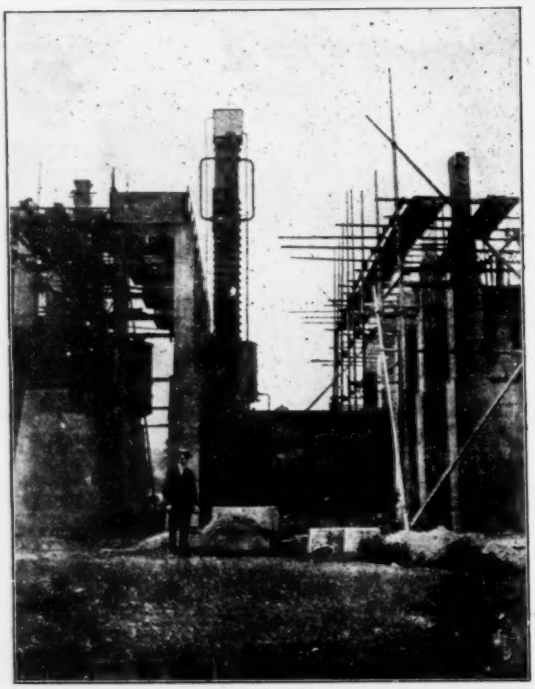

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